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ABSTRACT

This curriculum guide, one of a series of trade and industrial education teaching guides, was developed in Oklahoma by carpenters and vocational educators to assist the teaching of carpentry skills. Instructional material in the manual is written in terms of student performance, using measurable behavioral objectives. The manual contains 4 sections organized in 14 instructional units. They are designed in a standard format that includes eight basic components: performance objectives, suggested activities for the teacher, information sheets, assignment sheets, job sheets, transparency masters and supplements, tests, and answers to tests and assignment sheets. Depending on the specific objectives, there may or may not be transparency masters, supplements, assignment sheets, or job sheets included in the unit of instruction. Units of instruction are designed for use in more than one class period. Units cover the following subjects: (1) introduction--the free enterprise system, America's infrastructure, starting a business, industry orientation, and safety and basic first aid; (2) fundamentals of construction--basic mathematics, measuring, plan reading, and lumber; (3) tools--hand tools, power tools, and miscellaneous equipment; and (4) site--builder's level and transit, and site layout. (KC)

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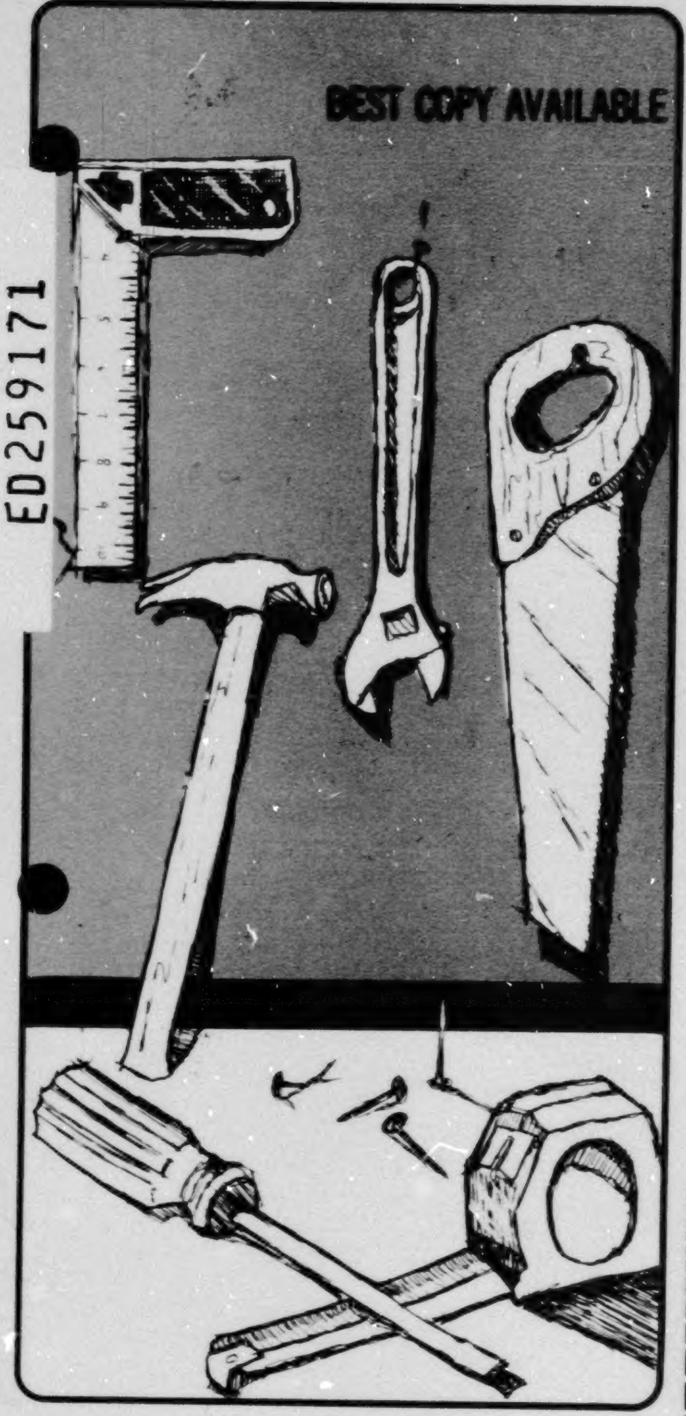

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Fundamentals of Carpentry

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PREFACE

For many years contractors and those responsible for training carpenters felt the need for instructional materials to be used in training. In 1974, The Associated General Contractors of America (AGC), with the cooperation and support of the Oklahoma State Department of Vocational and Technical Education, Curriculum and Instructional Materials Center (CIMC), accepted the challenge and produced a manual for use in training carpenters in those areas in which they are expected to be proficient. In 1978, and again in 1983, AGC and the CIMC decided that there was a need to update this manual in order to keep up with the ever-changing materials, skills, and demands of the profession.

Carpentry instructors are faced with the challenge of providing students with the skill and related information necessary to meet the demands of a changing profession. Competition for jobs is greater than ever. Therefore, the carpenter must be better trained and better equipped to find and retain meaningful employment. This is why AGC and CIMC felt a need to revise and update this manual.

Instructional material in this manual is written in terms of student performance, using measurable behavioral objectives. This is an innovative approach to teaching that accents and augments the teaching/learning process. Criterion-referenced evaluation instruments provide for a uniform measurement of student progress.

The purpose of this manual is to assist carpentry instructors in providing instruction throughout the industry. This publication should be supplemented by each instructor's methods and materials. Any information in this manual that does not concur with the instructor's course of study should be modified to meet personal needs.

ACKNOWLEDGEMENTS

Appreciation is expressed to the many individuals who contributed their time, talents, and knowledge in the preparation of the revision of this manual.

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FUNDAMENTALS OF CARPENTRY

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FOREWORD

In 1972, The Associated General Contractors of America (AGC) met with representatives of the Oklahoma Curriculum and Instructional Materials Center (CIMC) to discuss the possibilities of developing, as a cooperative project, a course of instruction designed for training carpenters who will make their careers in construction.

This publication is the result of those original discussions and the product of close coordination among general contractors, carpenters, people who actually work in construction, and vocational educators. This manual represents a conscious effort to meld the practical experience of personnel in the construction industry with the best instructional methods of those in the field of vocational education.

The trainers of skilled construction workers are faced with the challenge of providing thorough and modern training to the backbone of the construction industry, its work force. The purpose of this manual is to assist instructors in providing a high-caliber instructional program. In 1978, and again in 1983, AGC and CIMC decided that there was a need to update this manual in order to keep up with the ever-changing materials, skills, techniques, and demands of the profession. Therefore, we have revised this manual with these changes in mind. Although the format reflects a systematic approach to instructional materials development and the latest in educational technology innovations, the information in *Fundamentals of Carpentry* should be adapted and modified to coincide with local conditions. To make the training process complete, the materials should be coupled with the instructor's own methods, experience, and additional materials.

Dr. Francis Tuttle, Director
Oklahoma State Department of
Vocational and Technical Education

H. Pratt Farnsworth, Jr., Chairman
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of America

USE OF THIS PUBLICATION

Instructional Units

Fundamentals of Carpentry contains four sections and fourteen instructional units. A standard format was established in 1970 for development of instructional materials for all Oklahoma vocational teachers. This format includes eight basic components that form a unit of instruction: performance objectives, suggested activities for the teacher, information sheets, assignment sheets, job sheets, transparency masters and supplements, tests, and answers to tests and assignment sheets. Depending on the specific objectives. there may or may not be transparency masters, supplements, assignment sheets, or job sheets included in the unit of instruction.

All of the unit components "zero in" on measurable and observable learning outcomes. Teachers are encouraged to supplement, personalize, localize, and motivate with these materials in order to develop a complete teaching/learning process.

Units of instruction are designed for use in more than one lesson or class period of instruction. Careful study of each unit of instruction by the teacher will help him or her determine the following

- Amount of material that can be covered in each class period
- Skills that must be demonstrated
  Supplies and equipment needed
  Amount of practice needed
  Amount of class time needed for demonstrations
- Supplementary materials, such as pamphlets and filmstrips, that must be ordered
- Resource people to contact

Performance Objectives (white pages)

Each unit of instruction is based on the performance needed for successful employment in an occupational area. Performance objectives are stated in two forms: unit objectives, stating the subject matter to be covered in a unit of instruction; and specific objectives, stating the performance necessary to reach the unit objective. Since the objectives of the unit provide direction for the teaching/learning process, it is important that teachers and students have a common understanding of the intent of the objectives.

The objective sheet should be given to students and referred to throughout the teaching/learning process. This will help answer any questions concerning performance requirements for each instructional unit. The objectives can also help determine teaching strategies and instructional methods. Prepare for each unit by deciding how each objective can best be taught.

The objective sheet may also be used as a quick pretest to determine students' prior knowledge and to determine whether further study or activities are necessary. Teachers should feel free to modify, delete, or add objectives in order to meet the needs of the students and community. When changes in objectives are made, the teacher should remember to supply the needed information, assignment and/or job sheets, and criterion test items.

Suggested Activities (pink pages)

Suggested activities are included only in teacher materials. The suggested activities pages include an outline of the unit contents and an instructor's guide designed to assist teachers in planning their presentation of the unit. The instructor's guide provides suggestions for delivery and/or presentation during the instructional process. Read the suggested activities before teaching the units so that supplemental materials can be obtained, audiovisual materials prepared, and outside resources contacted. Duties of the teacher will vary according to the particular unit.

The references that are listed in the suggested activities are ones used in the development of each unit. They may be used by the teacher to supplement her or his knowledge of the subject area or to help students with particular interests or occupational objectives in the area covered.

The suggested activities section of the unit also includes supplements and transparency masters. Each of these components provides information in a special way. Supplements may consist of motivational materials, review or practice materials such as crossword puzzles and self-tests, or charts and reference materials. Supplements are designed to be copied and distributed to individual class members or to the class as a whole. Suggestions for their use are included in the instructor's guide. Transparencies direct the class' attention to the topic of discussion. Transparencies may present new information, or they may reinforce information presented in the information sheet. They are particularly effective when identification or analysis is necessary. Order transparencies from the Curriculum and Instructional Materials Center, or make transparencies and place them in the notebook where they will be immediately available for use.

Information Sheet (green pages)

The information sheet provides "must know" content essential for meeting the cognitive (knowledge level) objectives of the unit. The information is written in a topical-outline form and is keyed to the specific objectives.

Teachers will find that the information sheet serves as an excellent guide for presenting background knowledge necessary to develop the skills specified in the unit objective. The information sheet may also be used for coordination activities and advisory committees.

Students should read the information sheet before the information is discussed in class. Space is provided in margins for students and teachers to add notes that supplement, localize, personalize, or provide motivation for each unit.

Assignment Sheets (brown pages)

Assignment sheets give students a chance at problem solving, self-assessment, and/or practical experience. They assist students in the application of knowledges that are necessary prerequisites to skill development. Assignment sheets may be given to the student for completion in class or may be used for homework assignments. Answer sheets are provided when appropriate and can be used by the student and/or teacher for checking student progress. The scores of those assignment sheets listed in the specific objectives should be averaged with the unit test score, as the skills addressed in these assignment sheets are considered necessary in meeting the unit objective.

Job Sheets (blue pages)

Job sheets are another important segment of a unit of instruction. The job sheets provide a list of equipment, tools, and materials needed to complete a manipulative or psychomotor skill. They describe a step-by-step procedure needed to complete each task or job. Diagrams, photographs, and illustrations are provided to assist students in achieving the skill.

The teacher should demonstrate to students the procedures outlined in each job sheet. Furthermore, the teacher needs to localize the job sheet according to the equipment and supplies available in the local lab or shop situation. Job sheets also furnish potential employers with a picture of the skills being taught and the performances they might reasonably expect from a person who has had this vocational instruction.

Job sheet performance should be evaluated by the instructor and averaged with the unit test score, as the skills addressed in the job sheets are considered necessary in meeting the unit objective.

Tests (yellow pages)

The test provides criterion-referenced evaluation of every objective listed in the unit of instruction. It is crucial to note that both paper/pencil and performance objectives must be evaluated.

It is recommended that the tests be divided into shorter tests covering three or four objectives at a time and given soon after those objectives have been covered. A selection of questions from the units covered may be used for final tests at the end of each term if desired. If objectives have been added, deleted, or modified, be sure to make the changes on the test.

The acceptable response on a unit test, 85 percent in most units, may be raised or lowered to fit the topic or students' ability levels. The percentage applies to the overall score, not to each question. The final unit grade should be obtained by using the paper/pencil score and evaluations of student demonstrations of the desired skills.

Answers to Test and Assignment Sheets (pink pages)

Answers to test and assignment sheets are components designed to assist the teacher in evaluation of student performances.

Page Numbering

Each publication from the Curriculum and Instructional Materials Center (CIMC) is assigned a specific abbreviation. For example, *Fundamentals of Carpentry* has been abbreviated FC. The units are then numbered consecutively within each section. An example of a page number is FC-1-A. Since CIMC publications are loose leaf, this system of page numbering was adopted so that pages from different manuals would not get mixed up.

Methods of Disseminating Material

Material may be given out a unit or page at a time to keep the material before the student always new. Some teachers ask students to furnish a three-ring binder for the units. This is convenient for taking the materials home to study. Upon completion, each unit is then placed in a larger binder. The large binders may be purchased at cost from the CIMC. Some teachers store the materials by units in filing cabinets or boxes until needed. All the units may be given out at once if desired.

For best results, provide student materials for each student. Student materials contain everything but the test answers, answers to assignment sheets, and suggested activities. All tests are collated at the back of student material and should be removed and stored until needed.

Teaching Methods

It is a challenge to keep students motivated. Supplement the objectives by providing the "why," personal experiences, and current information. Prepare for each unit by deciding how each objective can best be taught. Allow students to become involved in preparing and planning.

Competency Profiles

Competency profiles are folders used to document student performance. The profile contains a list of the specific job competencies that a student should achieve prior to leaving the training program. Competency profiles may be ordered from the State Department of Vocational and Technical Education, Curriculum and Instructional Materials Center, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074, and from The Associated General Contractors of America, 1957 E. Street N.W., Washington, D.C. 20006.

CORRECTIONS AND SUGGESTIONS

The Curriculum and Instructional Materials Center (CIMC) wants to provide vocational instructors and students with materials that are accurate and effective. Although the CIMC strives to maintain the highest standards of development and production, oversights occasionally do occur. If you find any errors in this or other CIMC publications, or have suggestions for improving their usefulness in vocational programs, please notify the CIMC staff. One easy way of pointing out errors is to make a photocopy of the affected page and to indicate the correction on the copy. You can mail the information to the CIMC, where it will be used to correct the publication before the materials are reprinted.

To ensure that the material is updated on a timely basis, it is important that you notify the (CIMC) of necessary corrections as soon as possible after discovering the error. Do not assume that someone else will notice the error and inform the CIMC; other users may be making the same assumption. Please send corrections and recommendations for improving this publication to the following address:

Assistant Coordinator for Development
Curriculum and Instructional Materials Center
Oklahoma State Department of Vocational and
Technical Education
1500 West Seventh Avenue
Stillwater, Oklahoma 74074

FREE-ENTERPRISE SYSTEM
UNIT I

UNIT OBJECTIVE

After completing this unit, the student should be able to explain how the free-enterprise system works. The student will show this knowledge by completing the assignment sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match to their correct definitions terms associated with the free-enterprise system.
2. Match components of an economic system to their correct descriptions.
3. List the functions of an economic system.
4. Match types of economic systems to their correct descriptions.
5. Describe characteristics of a free-enterprise economy.
6. State facts about goods, services, and resources in a free-enterprise economy.
7. Select from a list facts about producers in a free-enterprise economy.
8. Select from a list facts about consumers in a free-enterprise economy.
9. List ways in which price is determined in a free-enterprise economy.
10. Select from a list ways in which price influences flows in a free-enterprise economy.
11. Discuss the role of government in a free-enterprise system.
12. Match to their correct descriptions economic goals in a free-enterprise system.
13. Analyze supply and demand.

FREE-ENTERPRISE SYSTEM
UNIT I

SUGGESTED ACTIVITIES

I. Unit contents

- A. Objective sheet
- B. Suggested activities
- C. Supplement #1 — Free-Enterprise System Crossword Puzzle
- D. Transparency master: TM #1 — Free-Enterprise Flow Chart
- E. Information sheet
- F. Assignment sheets
    - 1. Assignment Sheet #1 — Analyze Characteristics of a Free-Enterprise Economy
    - 2. Assignment Sheet #2 — Interpret a Free-Enterprise Flow Chart
    - 3. Assignment Sheet #3 — Interpret Price Influences in a Free-Enterprise Economy
    - 4. Assignment Sheet #4 — Collect Information on the Role of Government in a Free-Enterprise Economy
    - 5. Assignment Sheet #5 — Analyze Supply and Demand
- G. Answers to assignment sheets
- H. Test
- I. Answers to test

II. Instructor's guide

- A. Review unit and plan presentation.
- B. Obtain materials necessary to supplement unit.
    - 1. Transparency

        (NOTE: Transparencies and competency profiles for this book are available from the Oklahoma State Department of Vocational and Technical Education, Curriculum and Instructional Materials Center, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074, or from The Associated General Contractors of America, 1957 E Street, N.W., Washington, D.C. 20006; phone 202-393-2040.)

SUGGESTED ACTIVITIES

2. Copies of Supplement #1

3. Films

    a. *American Enterprise Series: Land.* Color, 29 minutes, Modern Talking Picture Service, 1976.

    b. *American Enterprise Series: Government.* Color, 29 minutes, Modern Talking Picture Service, 1976.

    c. *American Enterprise Series: Innovation.* Color, 29 minutes, Modern Talking Picture Service, 1976.

    (NOTE: This series is available on a free-loan basis to Oklahoma instructors. Oklahoma instructors may order from the Oklahoma State Department of Vocational and Technical Education, Curriculum and Instructional Materials Center, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074. Out-of-state instructors must order from Modern Talking Picture Service, 45 Rockefeller Plaza, New York, New York 10020.)

C. Introduce unit to students.

SUGGESTIONS:

- Discuss economics in general and relate the concept of supply and demand to real concerns of your students, such as buying a car, living on their own, the costs of clothes or dating.
- Play Monopoly or a similar game that uses free-enterprise theories, or use such games to illustrate concepts of the free-enterprise economy.
- Make a bulletin board display of magazine and newspaper reports on the economy and economic indicators.

  (NOTE: The National Federation of Independent Business prints a poster entitled "What's the Difference?" that compares the standards of living in Washington, D.C.; London, England; and Moscow, U.S.S.R. Copies are available free of charge to teachers ordering on school stationery from the National Federation of Independent Business, 150 West 20th Avenue, San Mateo, California 94403.)

D. Provide students with objective sheet.

E. Discuss unit and specific objectives, emphasizing that a number of the students may become independent contractors and that all of them will act as producers and consumers throughout their adult lives.

SUGGESTIONS:

- If possible, obtain carpentry-related statistics about job placement and the number of students that become independent contractors.
- Provide students with cost figures and other information regarding projects completed in your program in the past.
- Invite some independent contractors or construction company managers to discuss how their businesses are affected by free enterprise.

SUGGESTED ACTIVITIES

F. Provide students with information and assignment sheets.

G. Discuss information and assignment sheets.

1. Use Information Sheet, Section I to discuss terms associated with the free-enterprise system.

   SUGGESTIONS:

   - Use Supplement #1, "Free-Enterprise System Crossword Puzzle," to reinforce terms.
   - Have the students discuss the terms, using examples that they can relate to, such as their own personal property and competition on the football field or in completing a carpentry project.

2. Use Information Sheet, Sections II and III to discuss the essential components and the functions of the free-enterprise economy.

   SUGGESTIONS:

   - Have students complete Assignment Sheet #1 to reinforce your discussion.
   - Relate the components and functions to games such as Monopoly.

3. Use Information Sheet, Sections IV and V to discuss types of economic systems and the characteristics of a free-enterprise economy.

   SUGGESTIONS:

   - Use Transparency #1 to illustrate the characteristics of a free-enterprise system.
   - Have students complete Assignment Sheets #1 and #2 to reinforce their understanding of the characteristics of a free-enterprise economy.
   - Show film *American Enterprise Series: Land* to illustrate the concept of private property and to introduce the idea of supply.
   - Lead a group discussion to explore the history of a product with which the students are familiar to see how competition lowers prices and introduces improvements.

     EXAMPLES: Personal computers, video recorders, telephone service

   - Assign individuals or groups reports on the economic opportunities (or lack of opportunities) under other government systems.

SUGGESTED ACTIVITIES

4. Use Information Sheet, Section VI to discuss goods, services, and resources in a free-enterprise economy.

   SUGGESTION:

   - Discuss various goods and services and relate them to consumer demand, comparing items that are essential to life (food, shelter, medical care, etc.) and those that are not essential (entertainment, luxury cars, cosmetic surgery, etc.).

5. Use Information Sheet, Sections VII and VIII to discuss the roles of the producer and consumer within the free-enterprise functions of allocation, flow maintenance, and coordination.

   SUGGESTIONS:

   - Show the film *American Enterprise Series: Innovation.*
   - Provide the students with stories about successful entrepreneurs, especially those in real estate and construction.
   - Have the class discuss their own roles as producers and consumers.
   - Invite a local contractor or business person, or a group of such persons, to discuss work ethics, absenteeism, and other labor characteristics that impact upon production.
   - When discussing how producers raise the standard of living for consumers and how this has greatly increased the amount of leisure time, have the students think of time-saving products that are on the market now that were not on the market during their parents' or grandparents' lives. List their suggestions on the chalkboard.

     EXAMPLES: *Paper products*: Plates, tissues, diapers, napkins, bibs, etc.

     Disposable products: Syringes, thermometers, razor blades, lighters, etc.

     Services: Baby-sitting, housecleaning, painting, child-care centers

6. Use Information Sheet, Sections IX and X to discuss how price is determined and how it influences flows in the free-enterprise system.

   SUGGESTIONS:

   - Have students complete Assignment Sheets #3 and #4 to reinforce these concepts.

SUGGESTED ACTIVITIES

- Have the students contact various speciality contractors such as electricians, plumbers, and materials suppliers to compare prices.

- Lead the class in a discussion of how price enters into their own buying decisions.

- Use trade magazines to determine construction costs per square foot in various sections of the country and to explore factors that may influence those costs, such as wages for construction workers, the costs of materials, and the overall cost of living in each area.

7. Use Information Sheet, Section XI to discuss the role of the government in a free-enterprise system.

   SUGGESTIONS:

   - Show the film *American Enterprise Series: Government.*

   - Have the students complete Assignment Sheet #5 to reinforce this concept.

   - Provide students with documents that show the government in each of the roles described.

     EXAMPLES: Services provided by employment agencies and the Small Business Administration; consumer requirements as specified in government construction bid notices; regulations from OSHA and those in local building codes

   - Invite contractors and a government representative to discuss the roles of government in a free-enterprise system.

8. Use Information Sheet, Section XII to discuss the economic goals of the American people.

   SUGGESTIONS:

   - Tie in the information from Section XI to introduce this material by defining the American enterprise system as a *modified free-enterprise system.* Explain how the various levels of government intervene in the economic process so that the system is not totally "free." Relate ways in which government regulations are often designed to promote the economic goals listed, such as ensuring efficiency, stability, and justice.

   - Have the class discuss the importance of these goals in their own lives.

SUGGESTED ACTIVITIES

H. Give test.

I. Critique test and discuss test in class.

J. Reteach if necessary.

K. Complete appropriate section of competency profiles.

III. Unit references

A. Amos, Joe. *Distributive Education I: Course of Study.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1973.

B. Hendrix, Laborn J. "Bud." *Heavy Equipment Operator Basic Core.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and The Associated General Contractors of America, 1981.

C. Nelson, Frank W. *Group Instruction for Cooperative Programs.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1978.

D. Nelson, Robert E., James A. Leach, and Thomas J. Scalan. *Owning and Operating a Small Business: Strategies for Teaching Small Business Ownership and Management.* State Board of Education, Illinois Office of Education, June, 1976.

E. Olsen, Arthur R., and John W. Kennedy. *Economics: Principles and Applications,* 9th ed. West Chicago, Illinois: South-Western Publishing Company, 1978.

F. *Small Marketers Aid No. 71.* "Checklist for Going into Business." Washington, D.C.: Small Business Administration, August, 1970.

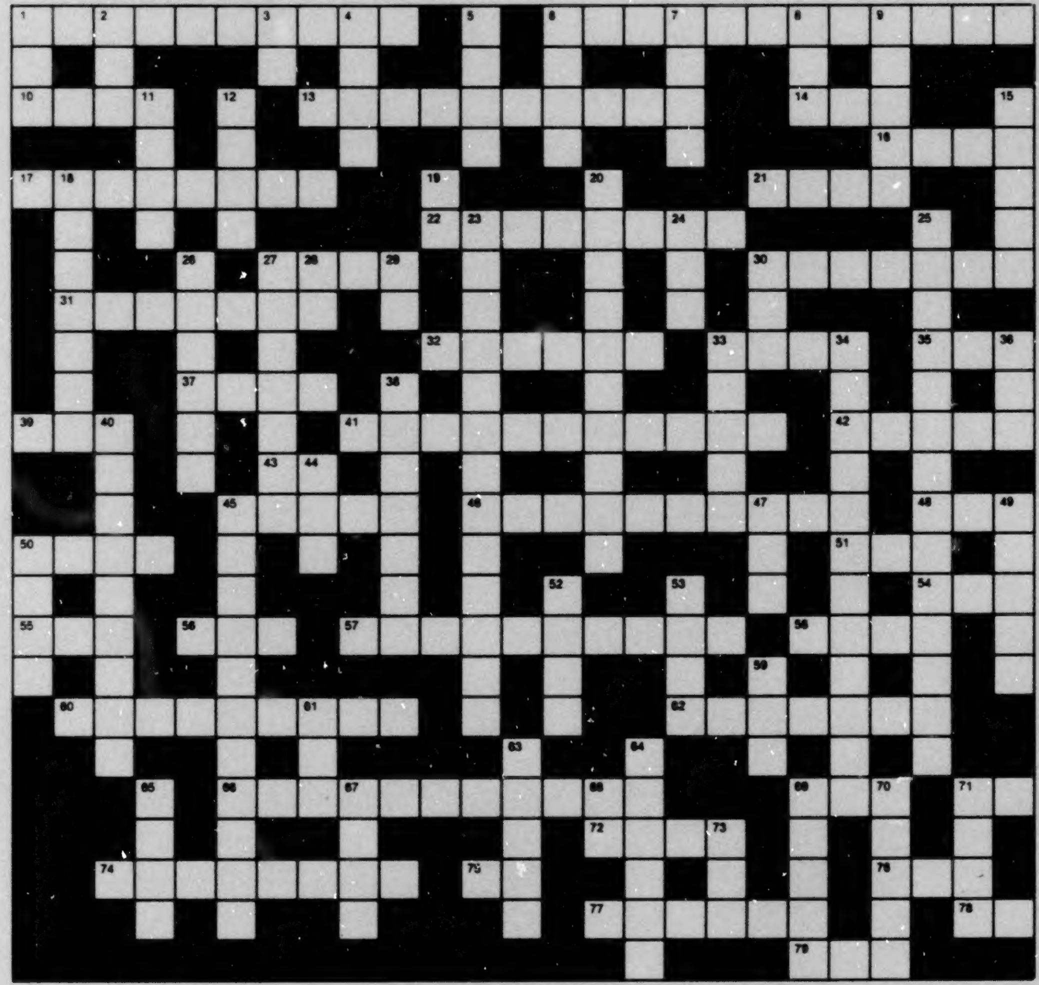
(NOTE: This booklet may be obtained free of charge by contacting the nearest office of the Small Business Administration.)

G. Wyllie, Eugene D., and Roman F. Warmke. *Free Enterprise in the United States.* Cincinnati, Ohio: South-Western Publishing Company, 1980.

SUGGESTED ACTIVITIES

SUPPLEMENT #1 — FREE-ENTERPRISE SYSTEM CROSSWORD PUZZLE

Review your understanding of terms and definitions associated with a free-enterprise system by completing the crossword puzzle below. Clues and solution are on the following pages.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SUPPLEMENT #1

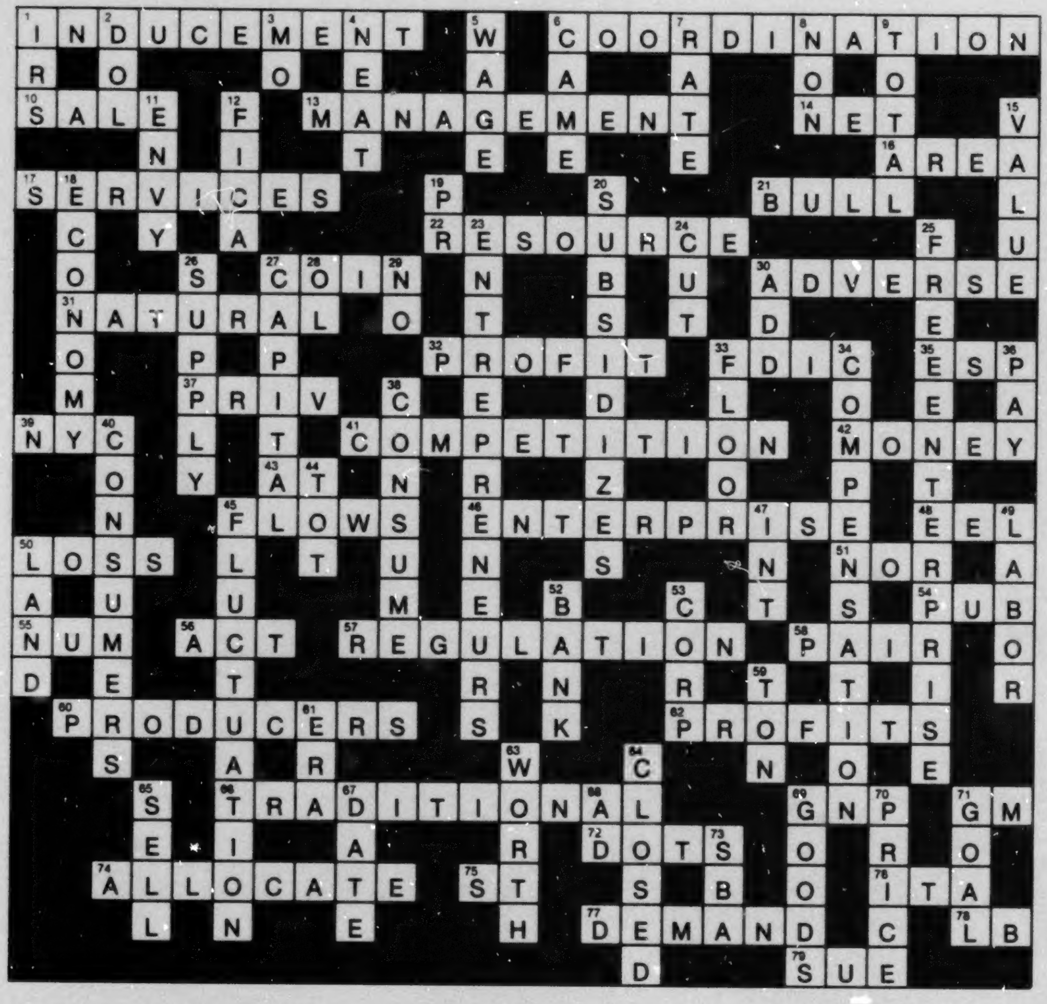
ACROSS

1. Benefit
6. Influence of group and individual decisions on economic system
10. Special offering of goods at prices lower than usual
13. Person or persons tasked with coordinating resources toward making a profit
14. Salary after taxes and deductions
16. Length times width
17. Work done or duties performed for another
21. Opposite of stockmarket "bear"
22. Labor, land, water, or fuel
27. Piece of metal used as money
30. Unfavorable or harmful
31. Type of resource
32. Money that a producer has left after selling goods or services and paying all expenses required for the production process
33. Federal Deposit Insurance Corporation (abbr.)
35. Extrasensory perception (abbr.)
37. Opposite of 54 across
39. Big Apple (abbr.)
41. Efforts made to attract consumers by two or more producers offering similar goods or services
42. Medium of exchange in the U.S.
43. Preposition
45. Exchanges
46. Undertaking or project; a business
48. Long, thin fish
50. Opposite of 32 across
51. Neither . . .
54. Property held by the government for use by all citizens (abbr.)
55. Numeral (abbr.)
56. Decision of a court or legislature; law, decree
57. Process of controlling, directing, or governing according to a rule, principle, or system
58. Two of a kind
60. Those who provide goods and services
62. Plural of 32 across
66. Type of economic system
69. Gross National Product (abbr.)
71. Gram (abbr.)
72. Periods
74. Distribute
75. Street (abbr.)
76. International Trade Association (abbr.)
77. Amount of a resource, good, or service that will be bought by consumers at a specific time for a given price
78. Pound (abbr.)
79. To bring legal suit

DOWN

1. Internal Revenue Service (abbr.)
2. Dollar (abbr.)
3. Money order (abbr.)
4. Tidy
5. Money received in exchange for a service performed
6. Past tense of *come*
7. Fixed ratio or proportion; the - - - - of exchange
8. Prefix meaning *not*
9. Sum
11. Jealousy
12. Federal Insurance Contributions Act (abbr.)
15. Worth of an item; price or cost
18. System of producing, distributing, and consuming wealth
19. Price (abbr.)
20. Supports with a grant of money
23. Persons who organize and manage a business, assuming the risk of the business for the purpose of making a profit
24. Decrease in salary
25. Type of economic system that allows individual economic decisions (2 wds.)
26. Amount of resource, good, or service that is available for exchange at a specific time for a given price
27. Wealth (money or property) used or capable of being used in production
28. Old Latin (abbr.)
29. Negative answer
30. Addition (abbr.)
33. That part of stock exchange upon which members stand
34. Anything given as an equivalent; payment for services
36. Take-home - - -
38. Use up products or services
40. Those who pay to receive goods and services
44. Total (abbr.)
45. Continual and irregular change; up and down movement
47. Interest (abbr.)
49. Physical and mental effort required to design, produce, and deliver goods and services
50. One of our natural resources
52. Money-lending institution
53. Corporation (abbr.)
59. 2,000 pounds
61. Equal Rights Amendment (abbr.)
63. Value or cost of items as determined by producers and consumers
64. Another name for directed economic system
65. Opposite of *buy*
67. Month, day, year
68. Advertisement (abbr.)
69. Partner of 17 across
70. Value asked
71. Objective; aim
73. Small Business Administration (abbr.)

SOLUTION TO SUPPLEMENT #1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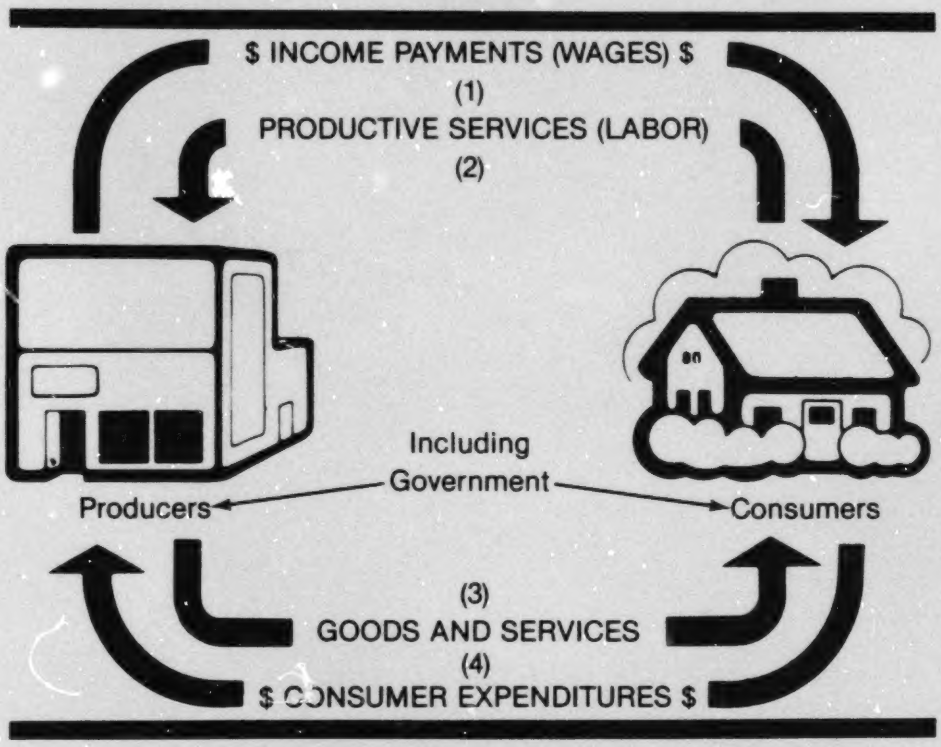
Free-Enterprise Flow Chart


$ INCOME PAYMENTS (WAGES) $
(1)
PRODUCTIVE SERVICES (LABOR)
(2)
Including
Government
Producers
Consumers
(3)
GOODS AND SERVICES
(4)
$ CONSUMER EXPENDITURES $

EXPLANATION

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1. How production is shared — payment for resources (both labor and materials) according to how they satisfy consumer wants.
2. How to produce — the use of productive services (land, labor, capital, and management) in a production process to satisfy wants.
3. How much to produce — amount of goods and services produced as determined by consumer spending.
4. What to produce — the demand for goods and services as expressed by consumer spending.

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FREE-ENTERPRISE SYSTEM
UNIT I

INFORMATION SHEET

I. Terms and definitions

A. Enterprise — Undertaking or project; a business

B. Economic system — Design, normally established by a government, to control the production, distribution, and consumption of goods and services

EXAMPLES: Free enterprise, closed, traditional

C. Flows — Exchange of goods and services for money

D. Allocation — Distribution

E. Compensation — Anything given as an equivalent; payment for services

F. Labor — Physical and mental effort required to design, produce, and deliver goods and services

G. Natural resources — Land, water, fuels, and raw materials required for production

H. Capital — Wealth (money or property) used or capable of being used in production

I. Management — Person or persons tasked with coordinating resources toward making a profit

J. Regulation — Process of controlling, directing, or governing according to a rule, principle, or system

K. Entrepreneur — Person who organizes and manages a business, assuming the risk of the business for the purpose of making a profit

L. Economic value — Worth of an item in satisfying the wants and needs of producers and consumers; price or cost

M. Medium of exchange — Anything used as a measure of value in exchange for goods and services

EXAMPLES: Currency, checks, services

N. Supply — Amount of a resource, good, or service that is available for exchange at a specific time for a given price

INFORMATION SHEET

O. Demand — Amount of a resource, good, or service that will be bought by consumers at a specific time for a given price

P. Profit — Money that a producer has left after selling goods or services and paying all expenses required in the production process

II. Components of an economic system

A. Goods and services — Material objects and assistances provided to satisfy the wants or needs of individuals who are willing to pay to obtain them

EXAMPLES: *Goods:* Food, clothing, housing, books, tools, lumber
Services: Cooking, tailoring, construction, printing, tool repair, equipment rental

B. Resources — Materials, facilities, planning, and organization required to produce and distribute goods and services

(NOTE: Resources are sometimes referred to as *factors of production.* Economists break resources into four categories: labor, land or natural resources, capital, and management.)

C. Producers — Those who provide goods and services

D. Consumers — Those who pay to receive goods and services

E. Regulating factors — Aspects of the economic system that determine allocation, flows, and coordination

(NOTE: A regulating factor may be part of the economic philosophy of the system, such as religious beliefs in a traditional system or freedom of choice in a free-enterprise system, or the regulation may be imposed by an individual or agency, such as a government in a closed system.)

F. Medium of exchange — Means used to provide compensation for resources or goods and services

(NOTE: The medium of exchange in an economic system is the basis for placing values on all that is bought and sold. Generally, a monetary system is established and used as the basis of relative values. This allows comparisons to be made, for example, between the value of a skilled carpenter's time and the value of a radial arm saw. However, exchanges may be made without a monetary system, either by comparing the value of two things directly or by using another standard such as gold.)

INFORMATION SHEET

III. Functions of an economic system

   A. Resource allocation

   B. Maintenance of flows

   C. Coordination

   (NOTE: Coordination is the influence on the economic system of group and individual decisions.)

IV. Types of economic systems

   A. Traditional economy — Tradition, customs, and religious beliefs influence economic functioning; people are content to continue living as their parents and ancestors have

   EXAMPLES: Isolated tribes of aborigines, island dwellers, inhabitants of remote mountainous areas

   B. Closed (directed) economy — Economic functioning is controlled primarily by the decisions of an authoritative body or individual, usually the government

   EXAMPLES: Communist countries such as the U.S.S.R., North Korea, Red China; socialist countries such as Great Britain, Spain, Italy

   (NOTE: Political structures are often based on the economic philosophies of those who set up the government.)

   C. Free-enterprise (market) economy — Economic decisions are made primarily by individuals who have the freedom to choose how they will spend their money, invest their time and energy, and set their economic goals

   EXAMPLES: United States, Australia, Canada

   (NOTE: These types of economic systems are broad categories that describe the basis for any actual system. It would be difficult to find any economic system in the world today that falls neatly into one category without exhibiting characteristics of the other types, especially at the national level. For example, although the United States operates under a primarily free-enterprise system, many of the economic decisions and goals of individuals are influenced by traditions and religious beliefs. Additionally, government control and regulation of some companies, such as utilities and defense contractors, resemble a closed economy.)

INFORMATION SHEET

V. Characteristics of a free-enterprise economy

   A. Private property — That portion of personal income kept by the individual in the form of money, owned material goods, and investments such as stocks and bonds

      (NOTE: In a free-enterprise system, the majority of property is privately owned, being held either by individuals or by individuals through private businesses. Some property, such as public schools, highways, national and state parks, is referred to as *public property* because it is held by the government for the use of all citizens. Under some economic systems there is little or no ownership on the part of private citizens.)

   B. Freedom of choice — Right of consumers to spend their money as they desire and of producers to become involved in any legal business

      (NOTE: Freedom of choice is essential in a free-enterprise economy. The choices made by consumers help to determine what producers will provide, how much of it will be provided, and the price at which it will be sold.)

   C. Profit motivation — Desire of producers to increase their private-property holdings

      (NOTE: The desire to make a profit leads entrepreneurs to establish businesses, which in turn creates jobs and provides additional or better goods and services.)

   D. Competition — Efforts made to attract consumers by two or more producers offering similar goods or services

      (NOTE: Competition between producers in a free-enterprise economy is a chief factor in the production of quality products at low prices. Competitors attempt to attract consumers by offering lower prices, added services or features, new or improved products, or by other means attractive to consumers.)

VI. Goods, services, and resources in a free-enterprise economy

   A. Goods, services, and resources have an economic value

   B. Economic value is usually stated in terms of the medium of exchange in the system

      (NOTE: In the United States, the dollar is the basic monetary unit, and economic value is stated in terms of dollars. Thus, a new circular saw may be worth $150, and an hour of work from a frame carpenter may be worth $18.)

   C. Exchanges (flows) of goods, services, and resources occur within the free-enterprise system

INFORMATION SHEET

D. Economic value is the basis for the exchanges made within the system

(NOTE: Individuals exchange their labor for money and then spend the money for goods and services. Thus, a resource is exchanged by a consumer for a good or service.)

E. Economic values rise and fall, depending on consumer demand and available supplies

(NOTE: Many variables enter into establishing the economic values of resources, goods, and services, with all such variables being interrelated and affected by one another. Two of the more important are *supply* and *demand.*)

VII. Producers in a free-enterprise economy

A. Allocation

1. Convert resources into goods and services that are wanted and needed by consumers

EXAMPLE: Raw iron ore is converted to steel, which is then converted into automobiles.

2. Provide the management necessary to supply goods and services

B. Flows

1. Make consumers aware of new products, processes, and services; and provide a means of distribution of such items

2. Help to fund the cost of the government

(NOTE: Taxes paid by business and industry help to finance government agencies and programs, thus lowering the tax burden of individuals.)

C. Coordination

1. Perform tasks beyond the capabilities of most consumers

EXAMPLE: A pharmaceutical company develops a vaccine for a disease.

2. Raise the standard of living for consumers

(NOTE: The amount of leisure time and the ways of spending it have greatly increased over the years. This is largely because new products have become available or because people are able to purchase services that they formerly would have had to do themselves. Life for consumers is healthier and more rewarding because of the contributions made by producers.)

INFORMATION SHEET

3. Provide jobs

   (NOTE: Producers pay individuals for their time and skills. Additionally, many producers provide their workers with the facilities, equipment, and materials necessary to perform those jobs.)

VIII. Consumers in a free-enterprise economy

A. Allocation

1. Provide many of the natural resources and the labor used by producers
2. Make buying decisions that determine what is produced and how much is needed, thus influencing the use of resources

B. Flows

1. Make buying decisions that determine how much will be paid for goods and services
2. Make buying decisions that influence how much of a product is required and where it will be distributed

C. Coordination

1. Make buying decisions that help to set standards for industry

   EXAMPLE: Buyers expect a certain level of performance and dependability and certain standard features in the cars they purchase.

2. Affect the rate of growth in the economy through spending decisions and desires for goods and services

IX. Ways in which price is determined in a free-enterprise economy

A. Availability of resources

B. Collective buying decisions of consumers (demand)

EXAMPLE: Several years ago large American automobiles were selling better than small foreign automobiles. Today, consumers are purchasing more foreign automobiles. This demand has caused the price and supply of foreign automobiles to rise rapidly; the price of American automobiles has increased, but at a much slower rate.

C. Marketing surveys and reviews of past sales to determine what goods and services consumers will buy and at what price

INFORMATION SHEET

X. Ways in which price influences flows in a free-enterprise economy

A. Determines what will be produced by showing what goods and services are profitable

EXAMPLE: The selling price of sand is $3.75 per ton, and it costs the contractor $4.25 per ton to excavate; sand is not a profitable product for the contractor to sell.

B. Determines allocation of scarce resources

EXAMPLE: If diesel fuel is selling for $1.15 per gallon and kerosene is selling for $.90 per gallon, oil available to produce kerosene or diesel fuel will be used primarily to produce diesel fuel.

(NOTE: The producer will offer the product that will show the most profit.)

C. Determines methods of production for a good or service

EXAMPLE: If a home contractor can use a cheaper grade lumber to build a home and the consumer does not care, the contractor can reduce the cost of the product.

D. Determines what consumers are able to buy

EXAMPLE: If your income is $20,000 per year and you have no savings, you will not be able to buy a $250,000 home.

XI. Role of government in a free-enterprise economy

(NOTE: Everyone in a free-enterprise economy, including government, functions as both a consumer and producer. Government provides services such as postal and defense systems. It builds highways and public facilities. These activities and others require the use of resources. Additionally, government has a regulatory role in the economic system to ensure that economic goals are met and that producers and consumers can function with a degree of fairness in the marketplace.)

A. Resource allocation

1. Regulates use of resources

2. Legislates working conditions and wages

3. Imposes controls on some resources

EXAMPLES: Sets price for uranium ore, assists with education and training, regulates monopolies

INFORMATION SHEET

B. Flows

1. Subsidizes businesses that provide goods and services that might not be otherwise profitable

   EXAMPLES: Farming, railroads, airlines, manufacturers of defense products

2. Provides goods and services

3. Operates social programs

C. Coordination

1. Controls interest rates

2. Regulates international trade

3. Sets tax rates

4. Offers inducements for business expansion

5. Taxes at special rates some items considered to be luxuries

XII. Economic goals in a free-enterprise economy

(NOTE: One of the types of regulating factors in any economic system is the influence of traditions and social beliefs. In fact, these traditions and beliefs are largely responsible for determining what kind of system is in effect. Thus, the character of the citizenry influences a society's economic goals. The following is a list of the more important goals that influence allocation, flows, and coordination in a free-enterprise economy.)

A. Economic freedom — Right of producers and consumers to make economic decisions

B. Economic efficiency — Desire to use limited resources in the most productive and beneficial way

C. Economic growth — Desire for an ever-increasing standard of living

D. Economic stability — Freedom from major fluctuations in a nation's economy

EXAMPLES: Fluctuations include depressions and recessions; and great changes in interest rates, value of the monetary system, and employment rate.

INFORMATION SHEET

E. Economic justice — Fair distribution of society's resources and economic advantages

(NOTE: *Fair distribution* does not necessarily mean *equal* distribution. In a free-enterprise system, rewards go to those who have special skills, special knowledge, and greater abilities to contribute to the good of society. Thus, the more one produces for the good of society—as viewed by the society—the more one will obtain from the society.)

F. Economic security — Desire for a certain minimum standard of living for all members of the society

(NOTE: Social programs such as Medicare and urban renewal are attempts by the society to see that citizens who suffer hardship due to age, illness, unavoidable unemployment, economic fluctuations, and other adverse situations are not abandoned. Such efforts try to provide the disadvantaged with a share of the society's economic wealth.)

FREE-ENTERPRISE SYSTEM
UNIT I

ASSIGNMENT SHEET #1 — ANALYZE CHARACTERISTICS OF A FREE-ENTERPRISE ECONOMY

NAME ______________________________ SCORE ______________

The characteristics of a free-enterprise economy—private property, freedom of choice, profit motivation, and competition—are all interrelated. For example, a town may have only one roofing company that is able to handle the normal roofing needs. This company sets its prices high because of a lack of competition. Yet, after a hailstorm, the consumers' need for roofing increases, creating a larger market. As a result, roofing contractors from outside the town may send crews to the town to share in the potential profit caused by the expanded market. The original company will probably have to lower prices in order to compete.

Use your local telephone book to analyze the characteristics of a free-enterprise economy. This exercise will give you a good idea of how many businesses in your area are competing with each other for the consumers' dollars.

PART I

Use the Yellow Pages of your telephone book to determine the number of business firms competing for consumers' dollars for the following goods and services. Write the names of the companies or businesses in the blanks provided.

A. Equipment rentals

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________

B. Excavating companies

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________
9. ______________________________
10. ______________________________

ASSIGNMENT SHEET #1

C. Income-tax services

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________

D. Lumberyards

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________

E. Telephone companies

1. ____________________
2. ____________________
3. ____________________
4. ____________________

F. Hospitals (general medical and services)

1. ____________________
2. ____________________
3. ____________________
4. ____________________

PART II

Analyze the information collected in the survey to answer the following questions.

A. Which business appears to have the most competition for consumers' dollars? Explain your answer.

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B. How do most firms demonstrate the free-market system?

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ASSIGNMENT SHEET #1

C. What did the survey show you about profit motivation and business firms in your area?

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D. What did the survey show about the use of private property by business?

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PART III

Read the following case studies that demonstrate characteristics of the free-enterprise system at work. Write an "X" in the blanks before the characteristics you believe are at work, and explain your answers. More than one answer may be correct.

A. Jane Smith has $35,000 in savings and plans to use the money to start a cabinetmaking company. Jane conducted a survey of the people in the city in which she wants to locate the business. The survey shows a need for a cabinetmaking company, so Jane decides to open the business.

_____ 1. Private property

Why?______________________________

____

____

_____ 2. Freedom of choice

Why?______________________________

____

____

_____ 3. Profit motivation

Why?______________________________

____

____

ASSIGNMENT SHEET #1

_____ 4. Competition

Why?____

____

____

B. John Jones owns and operates a power tools store. John employs four salespeople and a stock clerk. He has decided to change his business from a full-service to a self-service store in an effort to lower expenses and increase profits. The number of employees will be reduced to two, a cashier and a stock person.

_____ 1. Private property

Why?____

____

____

_____ 2. Freedom of choice

Why?____

____

____

_____ 3. Profit motivation

Why?____

____

____

_____ 4. Competition

Why?____

____

____

ASSIGNMENT SHEET #1

C. Pat James owns and operates a small lumberyard. Pat has decided to increase the goods provided by the shop in an effort to offer items that the other lumberyard in town does not carry. The goods that will be added are hand tools and equipment. Pat will have to borrow $10,000 from a relative to add these goods.

_____ 1. Private property

Why?____

____

____

_____ 2. Freedom of choice

Why?____

____

____

_____ 3. Profit motivation

Why?____

____

____

_____ 4. Competition

Why?____

____

____

FREE-ENTERPRISE SYSTEM
UNIT I

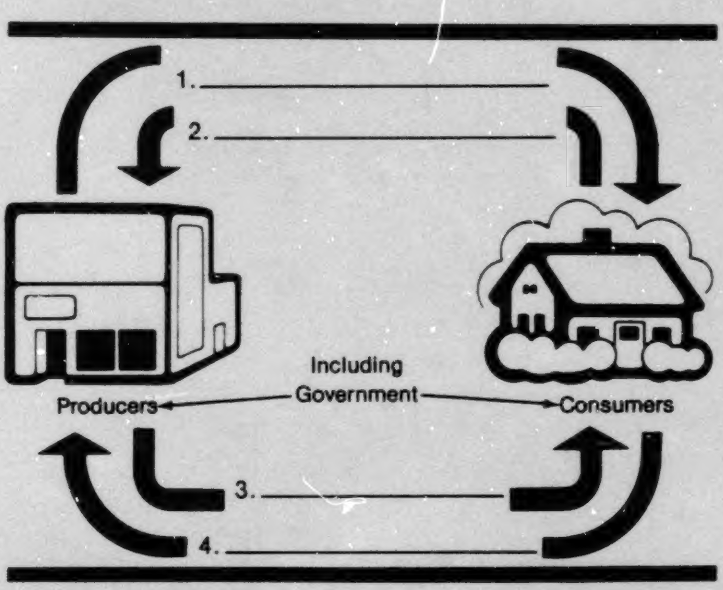
ASSIGNMENT SHEET #2 — INTERPRET A FREE-ENTERPRISE FLOW CHART

NAME ______________________________ SCORE ____________

One of the most important concepts to understand about the free-enterprise system is the constant exchange that goes on between producers and consumers, and how such flows affect supply and demand. Even if you never own your own business, you will be offering your skills and time as products for sale, with your wages being the payment for your product. Additionally, you will act as a consumer of goods and services provided by others.

Interpreting the following free-enterprise flow chart will help you understand how basic economic questions are determined in a free-enterprise economy.

A. Label the flow chart below.



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B. How would the following changes within the free-enterprise economy normally affect flows in the system? Write an "X" in the blank before each correct answer.

1. If consumers' demand for goods and services increases, and the producer provides more goods and services, the producer's demand for productive services (land, labor, capital, and management) will

_____a. Increase _____b. Decrease _____c. Not change

ASSIGNMENT SHEET #2

2. If the producer demands more productive services and the consumers supply more, payment to consumers for productive services will

______a. Increase ______b. Decrease ______c. Not change

3. If consumer expenditures for goods and services increase, the amount of goods and services produced will

______a. Increase ______b. Decrease ______c. Not change

4. If the producer pays less for productive services, the amount paid by consumers for goods and services should

______a. Increase ______b. Decrease ______c. Not change

5. If the producer produces fewer goods and services and consumer expenditures indicate a demand for equally fewer goods and services, the cost paid by consumers for goods and services should

______a. Increase ______b. Decrease ______c. Not change

6. If consumers provide more productive services while the producer's demands for productive services remain the same, the amount the producer pays for productive services should

______a. Increase ______b. Decrease ______c. Not change

FREE-ENTERPRISE SYSTEM
UNIT I

ASSIGNMENT SHEET #3 — INTERPRET PRICE INFLUENCES IN A FREE-ENTERPRISE ECONOMY

NAME ______________________________ SCORE ____________

One of the major considerations experts use to analyze the economy is the number of new home starts and building permits issued. Our country's economy is closely tied to the state of the construction trades. As you become involved in this field, you will grow more aware of your role in influencing the economy and, in turn, more aware of how your business and standard of living are influenced by the economy.

Interpreting the following case studies will help you examine some of the relationships in a free-enterprise economy. Refer to Information Sheet, Section X as needed.

A. The Bryan Construction Company is planning to add one more floor plan to its housing development series. The company is considering two floor plans. The company estimates that they can sell ten houses of floor plan A at a profit of $14,000 each; or they can sell twelve houses using floor plan B, at a profit of $11,500 each.

Which floor plan should the company select to sell? Explain.

B. John and Susan Johnson are planning to buy a new location for their tool business. They have looked at two locations that they like. The locations are basically the same, except that location A includes 5 acres of land, and location B is a 100-foot lot. The monthly payments on location A are $1500, and the payments on location B are $1300. Based on their monthly income and their other financial obligations, the Johnsons decided that they could not afford location A.

What economic factor lead to the Johnson's decision? Explain.

ASSIGNMENT SHEET #3

C. A few years ago, there was a shortage of coffee in America. Because of this shortage, the coffee companies raised prices. Consumers objected to the price increase and began using less coffee. The decrease in the use of coffee affected the coffee companies' profits to the point that they decided to lower prices to a more reasonable level.

Discuss this supply and demand cycle in terms of consumer/producer relationships.

D. The Miller Building Materials Company has decided to conduct a marketing survey and to review the previous year's sales records for asphalt shingles. The purpose of the survey and review is to determine the style of shingles the consumers will buy and the price that the consumers will pay.

What consumer/producer relationships may have influenced Miller's decision to conduct a survey and review sales records? Explain.

FREE-ENTERPRISE SYSTEM
UNIT I

ASSIGNMENT SHEET #4 — COLLECT INFORMATION ON THE ROLE OF GOVERNMENT IN A FREE-ENTERPRISE ECONOMY

NAME ________________________________ SCORE ______________

One of the largest influences on the free enterprise system is the role of the various levels of government as consumer, producer, and regulator. You will find that every phase of construction is used to meet the consumer needs of government, and that numerous government agencies and regulations apply specifically to the carpentry trade. This assignment sheet will help you become familiar with some of the roles played by government in your trade.

PART I

Interview or contact by letter at least one agency from each of the following levels of government to determine the functions the agency performs and to see how government acts as a producer and regulator. Use the questions included in this assignment sheet to complete the interviews.

A. Federal

EXAMPLES: Federal Trade Commission
Food and Drug Administration
U.S. Postal Service
OSHA (Occupational Safety and Health Administration)
Department of Labor-Wage and Hour Administration
Social Security Administration

1. Name of agency ________________________________

2. With what type of business does the agency work? ______________________

____

____

____

____

3. What goods or services does the agency provide to these businesses?

____

____

____

ASSIGNMENT SHEET #4

4. What regulatory or protective functions are performed for these businesses?

B. State

EXAMPLES: Department of Human Services (welfare office)
State Employment Office
State Highway Department
State Department of Health
Department of Consumer Affairs
Corporation Commission

1. Name of agency ______________________

2. With what type of business does the agency work? ______________________

3. What goods or services does the agency provide to these businesses?

4. What regulatory or protective functions are performed for these businesses?

ASSIGNMENT SHEET #4

C. County or City

EXAMPLES: Board of County Commissioners
County Clerk
County Tax Assessor
County Surveyor
Highway Inspector
Buildings and Codes Department
City Engineer

1. Name of agency ____________________

2. With what type of business does the agency work? ____________________

3. What goods or services does the agency provide to these businesses?

4. What regulatory or protective functions are performed for these businesses?

ASSIGNMENT SHEET #4

PART II

Government agencies also serve as consumers. Contact one of the companies listed below to determine how government relates to that business as a producer, regulator, and consumer.

EXAMPLES:
- Bank or savings and loan company
- Excavating contractor
- Building contractor
- Day-care center
- Telephone company
- Gas company or electric company
- Hospital or nursing home
- Demolition contractor
- Manufacturing business

Type of business____

Name of business____

A. What goods or services are provided for the business by the following levels of government?

1. Federal — ____

2. State — ____

3. County or city — ____

ASSIGNMENT SHEET #4

B. How is this business affected by the regulatory functions performed by the following levels of government?

1. Federal — ____________________

____

____

____

2. State — ____________________

____

____

____

3. County or city — ____________________

____

____

____

C. What services or products does the company provide to each level of government?

1. Federal — ____________________

____

____

____

2. State — ____________________

____

____

____

3. County or city — ____________________

____

____

____

FREE-ENTERPRISE SYSTEM
UNIT I

ASSIGNMENT SHEET #5 — ANALYZE SUPPLY AND DEMAND

NAME ______________________________ SCORE ______________

Carpenters quickly learn how many buying decisions are required in the trade, especially for tools and materials. Prices for such purchases result from the principles of supply and demand. Analyzing the case study in this assignment sheet will help you develop a better understanding of the relationship between supply and demand.

Two ways of comparing supply and demand are supply and demand schedules and supply and demand curves. Read through the following schedules (Tables 1 through 3) and curves and then complete this assignment sheet by analyzing the case study given and the supply and demand schedule in Table 4.

TABLE 1

Redwood supply schedule

Price (per board foot)	Quantity (board feet)	Point on supply curve
$0.50	1,000	A
0.75	2,000	B
1.00	5,000	C
1.25	7,000	D

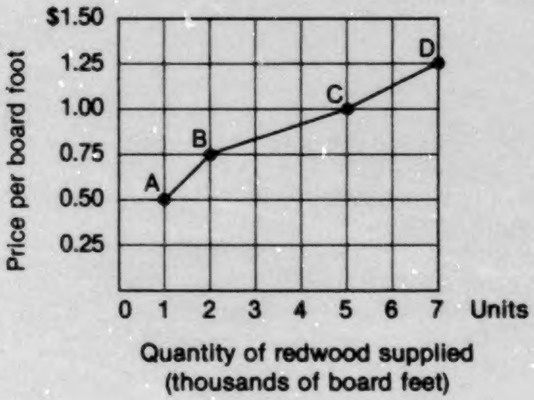
TABLE 2

Redwood demand schedule

Price (per board foot)	Quantity (board feet)	Point on demand curve
$1.25	1,000	A
1.00	3,000	B
0.75	4,000	C
0.50	7,000	D

ASSIGNMENT SHEET #5

Supply curve



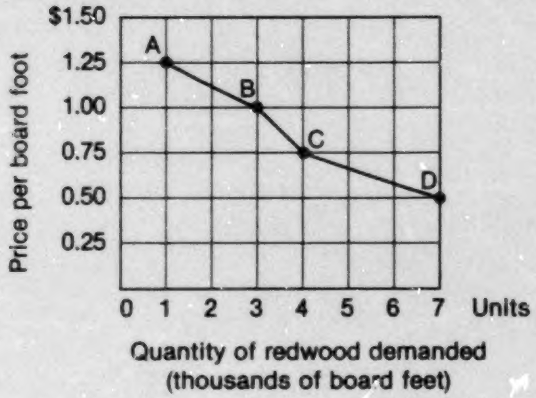
1. Price is always shown on the vertical axis

2. Quantity is always shown on the horizontal axis

3. Points on the supply curve are located by use of a supply schedule

4. Supply is normally graphed as an upsloping line because more is produced as price goes up

Demand curve



1. Price is always shown on the vertical axis

2. Quantity is always shown on the horizontal axis

3. Points on the demand curve are located by use of a demand schedule

4. Demand is normally graphed as a downsloping line because more is purchased as price goes down

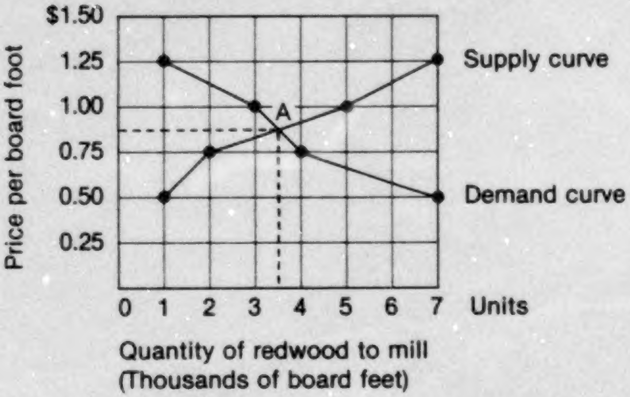
ASSIGNMENT SHEET #5

TABLE 3

Redwood supply and demand schedule

Price (per board foot)	Quantity supplied (board feet)	Quantity demanded (board feet)
$0.50	1,000	7,000
0.75	2,000	4,000
1.00	5,000	3,000
1.25	7,000	1,000

Supply and demand curve



A. The Fast-Cut Saw Company has conducted a survey to determine the number of saws to produce and the price to charge. The results of the survey have been placed in the following supply and demand schedule (Table 4)

TABLE 4

Saws supply and demand schedule

Price	Number supplied	Number demanded
$ 75.00	300,000	1,000,000
100.00	500,000	900,000
125.00	650,000	850,000
150.00	700,000	800,000
175.00	800,000	700,000
200.00	950,000	600,000
225.00	1,000,000	400,000

ASSIGNMENT SHEET #5

1. Construct a supply curve using the information in Table 4.

2. Construct a demand curve using the information in Table 4.

ASSIGNMENT SHEET #5

3. Construct a supply and demand curve using the information in Table 4.

B. Analyze your supply and demand curve to answer the following questions.

   1. How many saws should be produced? ________________________________

   2. What price should be charged for each saw? ________________________________

FREE-ENTERPRISE SYSTEM
UNIT I

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

Parts I and II evaluated to the satisfaction of the instructor

Part III

A. (2) Freedom of choice — As a producer Jane is free to choose a business to operate

(3) Profit motivation — Jane's survey determined the need for a cabinetmaking company in that city; Jane's decision to start the company is based on her desire to make money and the fact that the survey indicates that she should be able to

(NOTE: Students may list private property as another characteristic at work. There is some basis for this conclusion, but the instructor should use such a situation as an opportunity to explain how Jane's investment of private property also functions as the use of resources by her company.)

B. (3) Profit motivation — John has taken steps to reduce his expenses in order to increase profits

(NOTE: Profit motivation is the primary characteristic at work here. A student may justify to some extent that John has exercised freedom of choice in changing the business. Although competition may make it necessary for John to take this action, that cannot be determined from the information given.)

C. (1) Private property — The investment of $10,000 by Pat's relative represents the use of private property in the free-enterprise system

(4) Competition — Pat's decision to offer the additional goods is an attempt to make the lumberyard more attractive to consumers by providing goods not offered by Pat's competitor

(NOTE: Again, freedom of choice and profit motivation are also at work, but the primary principles illustrated in this case are private property and competition.)

Assignment Sheet #2

A. 1. Income payments
   2. Productive services (labor)
   3. Goods and services
   4. Consumer expenditures

B. 1. a
   2. a
   3. a
   4. b
   5. c
   6. b

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #3

A. Plan A; the profit from the sale of Plan A equals $140,000, and the profit from the sale of Plan B equals $138,000. The sale of Plan A would result in an additional $2,000 profit. The price of goods and services determines what will be produced by showing what goods and services are profitable

B. The price of goods and services determines what consumers are able to buy

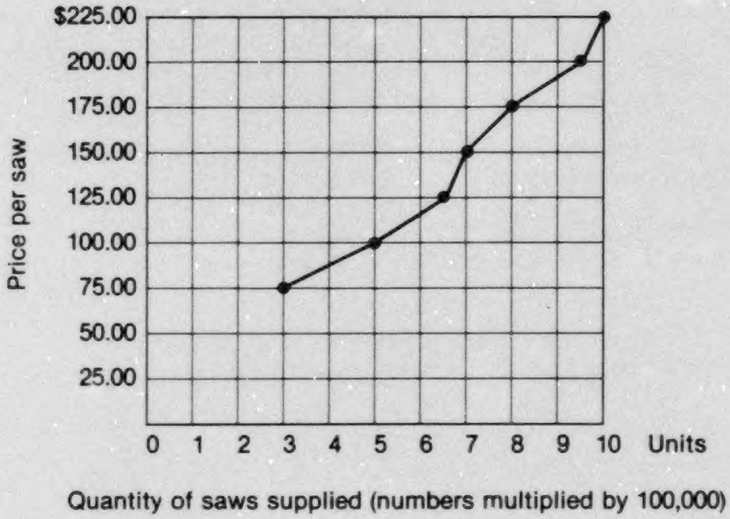
C. The collective buying decisions of consumers determines the price for goods and services

D. Business and industry conduct marketing surveys and review past sales records in an effort to determine what goods and services consumers will buy and what price consumers will pay

Assignment Sheet #4 — Evaluated to the satisfaction of the instructor

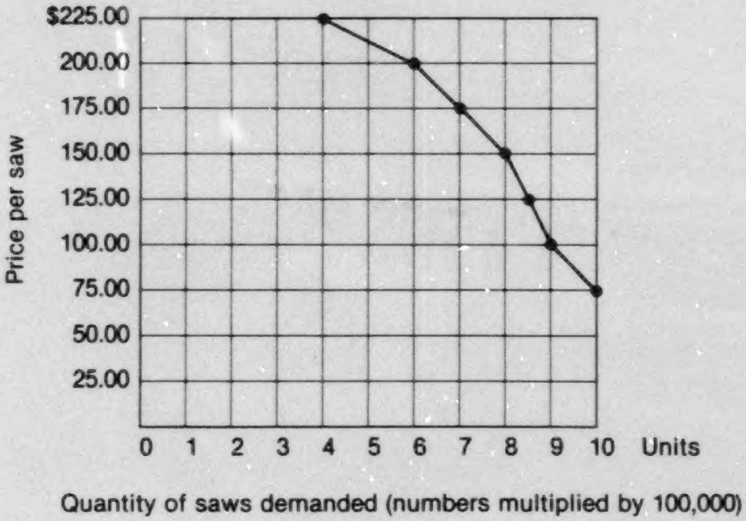
Assignment Sheet #5

A. 1. Supply curve

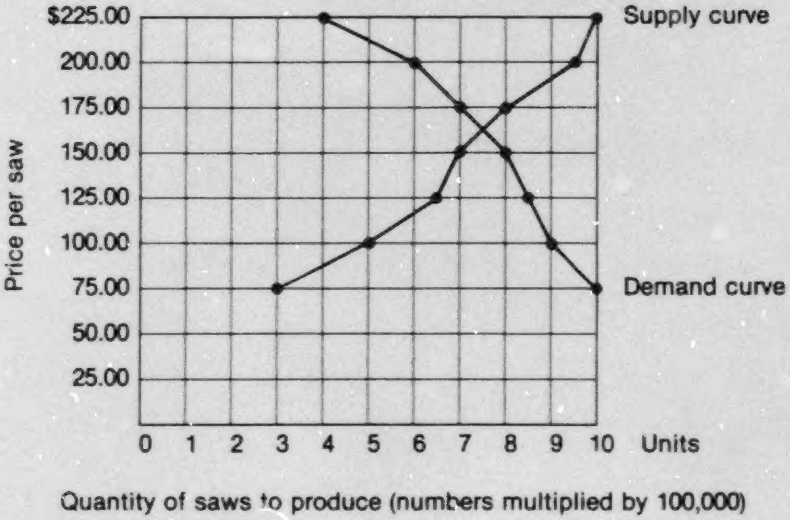


ANSWERS TO ASSIGNMENT SHEETS

2. Demand curve



3. Supply and demand curve



B. 1. 750,000 saws
2. $162.50

FREE-ENTERPRISE SYSTEM
UNIT I

TEST

NAME ________________________________ SCORE ______________

1. Match to their correct definitions terms associated with the free-enterprise system. Write the correct numbers in the blanks. Definitions are continued on the next page.

_____a. Exchange of goods and services for money

_____b. Distribution

_____c. Amount of a resource, good, or service that will be bought by consumers at a specific time for a given price

_____d. Anything used as a measure of value in exchange for goods and services

_____e. Worth of an item in supplying the wants and needs of producers and consumers; price or cost

_____f. Process of controlling, directing, or governing according to a rule, principle, or system

_____g. Wealth (money or property) used or capable of being used in production

_____h. Physical and mental effort required to design, produce, and deliver goods and services

_____i. Design, normally established by a government, to control the production, distribution, and consumption of goods and services

_____j. Undertaking or project; a business

_____k. Anything given as an equivalent; payment for services

_____l. Land, water, fuels, and raw materials required for production

_____m. Person or persons tasked with coordinating resources toward making a profit

_____n. Person who organizes and manages a business, assuming the risk of the business for the purpose of making a profit

1. Enterprise
2. Economic system
3. Compensation
4. Labor
5. Natural resources
6. Flows
7. Profit
8. Medium of exchange
9. Demand
10. Economic value
11. Regulation
12. Capital
13. Management
14. Entrepreneur
15. Allocation
16. Supply

TEST

______o. Amount of a resource, good, or service that is available for exchange at a specific time for a given price

______p. Money that a producer has left after selling goods or services and paying all expenses required in the production process

2. Match components of an economic system to their correct descriptions. Write the correct numbers in the blanks.

______a. Those who provide goods and services

______b. Materials, facilities, planning, and organization required to produce and distribute goods and services

______c. Aspects of the economic system that determine allocation, flows, and coordination

______d. Those who pay to receive goods and services

______e. Means used to provide compensation for resources or goods or services

______f. Material objects and assistances provided to satisfy the wants or needs of individuals who are willing to pay to obtain them

1. Goods and services
2. Consumers
3. Producers
4. Resources
5. Medium of exchange
6. Regulating factors

3. List the functions of an economic system.

a. ____

b. ____

c. ____

4. Match the following types of economic systems to their correct descriptions. Write the correct numbers in the blanks.

______a. Economic functioning is controlled primarily by the decisions of an authoritative body or individual, usually the government

______b. Economic decisions are made primarily by individuals who have the freedom to choose how they will spend their money, invest their time and energy, and set their economic goals

______c. Tradition, customs, and religious beliefs influence economic functioning; people are content to continue living as their parents and ancestors have

1. Traditional economy
2. Closed (directed) economy
3. Free-enterprise (market) economy

TEST

5. Describe characteristics of a free-enterprise economy.

   a. Private property — ____________________

   b. Freedom of choice — ____________________

   c. Profit motivation — ____________________

   d. Competition — ____________________

6. State facts about goods, services, and resources in a free-enterprise economy.

   a. ____________________

   b. ____________________

   c. ____________________

   d. ____________________

   e. ____________________

TEST

7. Select from the following list facts about producers in a free-enterprise economy. Write an "X" in the blank before each correct answer.

_____a. Convert resources into goods and services without consideration of consumer desires

_____b. Provide jobs

_____c. Help to fund the cost of the government

_____d. Perform tasks beyond the capabilities of most consumers

_____e. Lower the standard of living for consumers

_____f. Provide the management necessary to supply goods and services

_____g. Make consumers aware of new products, processes, and services; and provide a means of distribution of such items

8. Select from the following list facts about consumers in a free-enterprise economy. Write an "X" in the blank before each correct answer.

_____a. Provide many of the natural resources and the labor used by producers

_____b. Make buying decisions that determine what is produced and how much is needed, thus influencing the use of resources

_____c. Make buying decisions that determine how much will be paid for goods and services

_____d. Make buying decisions that influence how much of a product is required and where it will be distributed

_____e. Provide jobs

_____f. Provide the management necessary to supply goods and services

_____g. Make buying decisions that help set the standards for industry

_____h. Affect the rate of growth in the economy through spending decisions and desires for goods and services

9. List ways in which price is determined in a free-enterprise economy.

a. ______________________________

b. ______________________________

c. ______________________________

TEST

10. Select from the following list ways in which price influences flows in a free-enterprise economy. Write an "X" in the blank before each correct answer.

_____a. Determines what will be produced by showing what goods and services are profitable

_____b. Determines quality of goods and services

_____[illegible] Determines methods of production for a good or service

_____d. Determines allocation of scarce resources

_____e. Determines what consumers are able to buy

11. Discuss the role of government in a free-enterprise system.

a. Resource allocation — ____

____

____

____

b. Flows — ____

____

____

____

c. Coordination — ____

____

____

____

____

____

____

TEST

12. Match to their correct descriptions economic goals in a free-enterprise system. Write the correct numbers in the blanks.

_____a. Desire for an ever-increasing standard of living

_____b. Desire for a certain minimum standard of living for all members of the society

_____c. Right of producers and consumers to make economic decisions

_____d. Desire to use limited resources in the most productive and beneficial way

_____e. Fair distribution of society's resources and economic advantages

_____f. Freedom from major fluctuations in a nation's economy

1. Economic freedom
2. Economic efficiency
3. Economic growth
4. Economic stability
5. Economic justice
6. Economic security

(NOTE: Test question 13 lists the assignment sheet considered an important part of this test. If it has not been completed, check with your instructor.)

13. Analyze supply and demand.

FREE-ENTERPRISE SYSTEM
UNIT I

ANSWERS TO TEST

1. a. 6
   b. 15
   c. 9
   d. 8
   e. 10
   f. 11
   g. 12
   h. 4
   i. 2
   j. 1
   k. 3
   l. 5
   m. 13
   n. 14
   o. 16
   p. 7

2. a. 3
   b. 4
   c. 6
   d. 2
   e. 5
   f. 1

3. a. Resource allocation
   b. Maintenance of flows
   c. Coordination

4. a. 2
   b. 3
   c. 1

5. Description should include the following

   a. Private property — That portion of personal income kept by the individual in the form of money, owned material goods, and investments such as stocks and bonds
   b. Freedom of choice — Right of consumers to spend their money as they desire and of producers to become involved in any legal business
   c. Profit motivation — Desire of producers to increase their private-property holdings
   d. Competition — Efforts made to attract consumers by two or more producers offering similar goods and services

6. a. Goods, services, and resources have an economic value
   b. Economic value is usually stated in terms of the medium of exchange in the system
   c. Exchanges (flows) of goods, services, and resources occur within the free-enterprise system
   d. Economic value is the basis for the exchanges made within the system
   e. Economic values rise and fall, depending on consumer demand and available supplies

7. b, c, d, f, g

8. a, b, c, d, g, h

ANSWERS TO TEST

9. a. Availability of resources
   b. Collective buying decisions of consumers (demand)
   c. Marketing surveys and reviews of past sales to determine what goods and services consumers will buy and at what price

10. a, c, d, e

11. Discussion should include the following

   a. Resource allocation — Regulates use of resources; legislates working conditions and wages; imposes controls on some resources
   b. Flows — Subsidizes businesses that provide goods and services that might not otherwise be profitable; provides goods and services; operates social programs
   c. Coordination — Controls interest rates; regulates international trade; sets tax rates; offers inducements for business expansion; taxes at special rates some items considered to be luxuries

12. a. 3
   b. 6
   c. 1
   d. 2
   e. 5
   f. 4

13. Evaluated to the satisfaction of the instructor

AMERICA'S INFRASTRUCTURE
UNIT II

UNIT OBJECTIVE

After completing this unit, the student should be able to discuss the nation's infrastructure system and interpret how this infrastructure will affect the nation's construction industry in the future. The student will show this ability by completing the assignment sheet and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Define *infrastructure.*
2. Name classes of infrastructures.
3. Select from a list the purposes of an infrastructure.
4. Discuss the present condition of the nation's infrastructure.

AMERICA'S INFRASTRUCTURE
UNIT II

SUGGESTED ACTIVITIES

I. Unit contents

   A. Objective sheet

   B. Suggested activities

      1. Supplement #1 — Executive Preview of America's Infrastructure

      2. Transparency masters

         a. TM #1 — Projected Labor Need

         b. TM #2 — Major Labor Shortfall

   C. Information sheet

   D. Assignment Sheet #1 — Conduct a Survey of Specific Infrastructure Repair Needs in Your Community

   E. Answers to assignment sheet

   F. Test

   G. Answers to test

II. Instructor's guide

   A. Review unit and plan presentation.

   B. Obtain videotapes to supplement unit.

   (NOTE: The following videotapes are available to Oklahoma teachers on a free-loan basis from the Oklahoma State Department of Vocational and Technical Education, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074. Out-of-state teachers should contact the nearest AGC office.)

      1. "Building — Our Vertical Infrastructure." Color, videotape on ½- or ¾-inch VHS cassette.

      2. "AGC Infrastructure Medley 2." Color, videotape on ½- or ¾-inch VHS cassette.

SUGGESTED ACTIVITIES

C. Introduce unit to students.

SUGGESTIONS:

- Use information from Supplement #1 or provide the supplement to the students as a handout for discussion.
- Introduce the students to The Associated General Contractors of America (AGC) and other such groups.
- Invite an AGC representative or other person familiar with the infrastructure concept to talk to the class, emphasizing aspects of the infrastructure in your area.

D. Provide students with objective sheet.

E. Discuss unit and specific objectives, emphasizing how the infrastructure impacts on the construction industry.

F. Provide students with information and assignment sheets.

G. Discuss information and assignment sheets.

1. Use Information Sheet, Section I to broaden your explanation of infrastructure.

   SUGGESTIONS:

   - Show the videotapes to illustrate the concept of infrastructure and to introduce the next section of the information sheet.
   - Relate the idea of the infrastructure to production and consumerism as discussed in Unit I, "The Free Enterprise System," emphasizing the role of government and the nation's economic goals.

2. Use Information Sheet, Section II to discuss classes of infrastructures.

   SUGGESTIONS:

   - Relate the examples in this section and your own examples to the ideas of essential services and sustaining the standard of living.
   - Have the class identify and list specific buildings and structures in the community to illustrate the examples.

     (NOTE: You may want to save the list for use with Assignment Sheet #1 in conjunction with Objective 4.)

SUGGESTED ACTIVITIES

3. Use Information Sheet, Section III to discuss the purposes of an infrastructure.

   SUGGESTIONS:

   - Relate the various infrastructures to their purposes.
   - Have the students list specific ways in which the purposes outlined in Section III are met.

4. Introduce Information Sheet, Section IV by discussing the consequences of having an infrastructure that is unable to fulfill the stated purposes. Discuss the condition of the nation's infrastructure.

   SUGGESTIONS:

   - Use Table 1 to discuss needed infrastructure repairs, updating the information if possible.
   - Acquaint students with specific repair needs in your area by having them complete Assignment Sheet #1.
   - Have the students find and bring to class local newspaper articles dealing with infrastructure repair needs. Make a bulletin board display.
   - Use Transparencies #1 and #2 to supplement a discussion of job needs. Update the information if possible.
   - Discuss what the condition of the infrastructure means in terms of jobs and job opportunities in the carpentry profession.

H. Collect photographs of infrastructure repair needs in your area. Encourage the class to undertake a project to do something about these needs, such as making the public aware of the conditions, or offering their services to local agencies to assist in repairing the infrastructure.

I. Give test.

J. Reteach and retest as necessary.

K. Complete appropriate section of competency profiles.

(NOTE: Competency profiles are available from AGC and CIMC.)

III. Unit reference — "Infra-Structure." *Constructor,* Vol. LXV, No. 5 (May 1983).

SUGGESTED ACTIVITIES

SUPPLEMENT #1 — Executive Preview of America's Infrastructure

The nation's infrastructure is its system of public facilities, both publicly and privately funded, which provides for the delivery of essential services and a sustained standard of living. This interdependent, yet self-contained, set of structures provides for our mobility, shelter, services, and utilities. It is the nation's highways, bridges, railroads, and mass transit systems. It is our sewers, sewage treatment plants, water supply systems, and reservoirs. It is our dams, locks, waterways, and ports. It is our electric, gas, and power-producing plants. It is our courthouses, jails, firehouses, police stations, schools, post offices, and government buildings.

America's infrastructure is the base upon which society rests. Its condition affects our lifestyles and security, and each is threatened by its unanswered decay.

America has no acceptable alternative to urgently developing a program to rebuild the nation's public facilities, the skeleton of public works that provides society's basic and supporting services.

The almost daily casualty list of failing public facilities includes highways, bridges, water supply systems, sewage treatment plants, pipelines, and dams. But beyond that, the victims of neglect include schools, utilities, parks, hospitals, libraries, firehouses, and jails. These facilities and services touch every aspect of everyone's life.

The presently identifiable program cost to meet presently identified needs is approximately $3 trillion, according to estimates compiled by The Associated General Contractors of America (AGC).

There can be no question about the national urgency. The problems are not merely serious. Many are beyond the point where deterioration begins to accelerate at alarming rates and the hazards begin to compound themselves. The percentages of facilities in serious decay suggest the brutal reality:

- Nearly half of the nation's bridges are too weak to adequately handle the traffic loads.
- Almost one of every two paved miles of roads needs to be resurfaced or completely rebuilt.
- About 13 percent of the country's aging dams are classified as "high hazard."
- America's railroads must replace half of their ties over the next five years.
- Nearly half of the nation's sewage treatment plants are preventing economic growth because of inadequate capacity.
- Municipal water systems throughout the country are collapsing, threatening the quality of the water people consume, or failing to keep up with demand.

SUGGESTED ACTIVITIES

While the cost of repairs is great, there is no alternative, and the cost of delay is too high. The alternative to meeting the challenge is a continued and rapidly increasing deterioration in the nation's economic base, in the quality of life, and in the public's health. The General Accounting Office, for example, sees drinking water contamination "emerging as one of the most serious health and environmental problems facing our nation during the '80s."

A public facilities renewal program will also provide immense benefit to the economy and increased employment. Unemployment, which has weakened the nation's workforce, has hit nearly one million persons in the construction industry, about one out of every five. Each $1 billion spent on construction creates tens of thousands of on-site jobs and has a multiplier effect in related industries and fields that benefit from construction spending. For example, $1 billion spent on rebuilding our nation's highways would generate 13,100 on-site jobs and 63,000 jobs overall.

The complexity and scope of the nation's crumbling public facilities are a crisis and an opportunity. The crisis, as it becomes increasingly clear, threatens in very direct ways the nation's health, its safety, its economy, its workers, and its ability to meet the needs of today and tomorrow.

The opportunity is equally clear. It is to revitalize the national delivery of the vital services its citizens demand and to put them on a sounder financial base.

The needs could not be clearer, or more immediate. The price of delaying the task increases the ultimate cost to everyone.

Source: "AGC/CIMC Instructional Systems and Executive Preview" by John Friedemann, p. 3.

AMERICA'S INFRASTRUCTURE
UNIT II

INFORMATION SHEET

I. Definition of infrastructure

Infrastructure — System of public and private facilities that provides for delivery of essential services to sustain a minimum standard of living

II. General classes of infrastructures

A. Building infrastructures

EXAMPLES: Housing; hospitals; schools; prisons; police and fire stations; libraries; museums; storage buildings; stadiums; courthouses; federal, state, and local offices

B. Municipal utilities infrastructures

EXAMPLES: Potable water systems, wastewater treatment plants, drainage systems, flood control systems, curbs, gutters, sidewalks

C. Heavy industrial infrastructures

EXAMPLES: Locks, ports, waterways, dams, reservoirs, railroads, mass transit systems

D. Highway infrastructures

EXAMPLES: Highways, bridges, airports

III. Purposes of an infrastructure

A. To promote public health and safety

B. To provide transportation of goods and services

C. To aid in national defense

D. To improve quality of life and standard of living

E. To strengthen national economy

F. To produce energy

INFORMATION SHEET

IV. The present condition of the nation's infrastructure

A. The nation's infrastructure is greatly deteriorated and in need of immediate costly repairs (Table 1)

EXAMPLE:

TABLE 1

National infrastructure needs
(in billions)

Identified need	Cost
Highways	$1,570.3
Wastewater treatment	507.8
Drainage, minor flood control	169.4
Potable water (urban)	138.6
Hospitals	130.0
Housing (multifamily and low-income)	112.0
Dams/reservoirs	83.5
Airports	60.3
Railroads	60.1
Bridges	51.7
Educational facilities	49.0
Mass transit	37.2
Waterways	32.5
Locks	15.0
Prisons	7.0
Ports	3.7
Post offices	3.0
Total	$3,031.1

Adapted with permission of The Associated General Contractors of America, Washington, D.C., from "Infra-structure," *Constructor*, Vol. LXV, No. 5, May, 1983, p. 37.

INFORMATION SHEET

B. Repair and maintenance of the infrastructure will stimulate the economy by producing jobs (Table 2)

(NOTE: Labor requirements vividly illustrate how infrastructure repair and maintenance will affect job opportunities in future years. The Bureau of Labor Statistics estimates that 2.4 million additional workers will be required by 1990. Presently, existing training programs can be expected to provide only about 600,000 workers, leaving a shortage of 1.8 million skilled workers by 1990.)

EXAMPLE:

TABLE 2

New workers needed yearly

Worker	Number
Laborers	49,000
Highway construction workers	38,000
Equipment operators	36,000
Bricklayers	24,000
Plumbers and pipefitters	20,000

AMERICA'S INFRASTRUCTURE
UNIT II

ASSIGNMENT SHEET #1 — CONDUCT A SURVEY OF SPECIFIC INFRASTRUCTURE REPAIR NEEDS IN YOUR COMMUNITY

NAME ______________________________ SCORE ____________

The need for infrastructure rebuilding and maintenance is evident in many of the nation's communities. Often, these needs go unnoticed by the general public. Conduct a survey of local building, municipal, heavy industrial, and highway infrastructure facilities in your community.

Building infrastructure

Location ______________________________

Specific need ______________________________

____

____

Municipal infrastructure

Location ______________________________

Specific need ______________________________

____

____

Heavy industrial infrastructure

Location ______________________________

Specific need ______________________________

____

____

Highway infrastructure

Location ______________________________

Specific need ______________________________

____

____

AMERICA'S INFRASTRUCTURE
UNIT II

ANSWERS TO ASSIGNMENT SHEET

Assignment Sheet #1 — Evaluated to the satisfaction of the instructor

AMERICA'S INFRASTRUCTURE
UNIT II

TEST

NAME ____ SCORE ______________

1. Define *infrastructure.*

   Infrastructure — ____

   ____

   ____

   ____

2. Name classes of infrastructures.

   a. ____

   b. ____

   c. ____

   d. ____

3. Select from the following list the purposes of an infrastructure. Write an "X" in the blank before each correct answer.

   ______a. To promote public health and safety

   ______b. To provide transportation of goods and services

   ______c. To improve the appearance of the countryside

   ______d. To aid in national defense

   ______e. To improve quality of life and standard of living

   ______f. To strengthen national economy

   ______g. To produce energy

4. Discuss the present condition of the nation's infrastructure.

   ____

   ____

   ____

   ____

AMERICA'S INFRASTRUCTURE
UNIT II

ANSWERS TO TEST

1. Infrastructure — System of public and private facilities that provides for delivery of essential services to sustain a minimum standard of living

2. a. Building infrastructures
   b. Municipal utilities infrastructures
   c. Heavy industrial infrastructures
   d. Highway infrastructures

3. a, b, d, e, f, g

4. Discussion should include the following

   a. The nation's infrastructure is greatly deteriorated and in need of immediate costly repairs

   b. Repair and maintenance of the infrastructure will stimulate the economy by producing jobs

STARTING A BUSINESS
UNIT III

UNIT OBJECTIVE

After completing this unit, the student should be able to evaluate his or her potential to start a business. The student will show this ability by completing assignment sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match to their correct definitions terms associated with starting a business.
2. List primary factors that contribute to the success or failure of a business.
3. List major sources of information and assistance available to small-business owners.
4. Select from a list specific advisors available from the Small Business Administration.
5. Describe sources of capital used by entrepreneurs.
6. Examine expenses involved in starting a business.
7. Write a plan for small-business ownership.
8. Prepare documentation required for a loan application.
9. Explore problems faced by entrepreneurs in operating a business.
10. Evaluate own potential to start a business.

STARTING A BUSINESS
UNIT III

SUGGESTED ACTIVITIES

I. Unit contents

   A. Objective sheet

   B. Suggested activities

   C. Supplement #1 — Market Factor: When to Take the Risk

   D. Transparency masters

      1. TM #1 — Organizational Plans in Trouble

      2. TM #2 — Organizational Plans in Trouble (Continued)

      3. TM #3 — Organizational Plans in Trouble (Continued)

      4. TM #4 — Sources of Borrowing Short-Term Capital

      5. TM #5 — Standards for Small-Business Loans

   E. Information sheet

   F. Assignment sheets

      1. Assignment Sheet #1 — Examine Expenses Involved in Starting a Business

      2. Assignment Sheet #2 — Write a Plan for Small-Business Ownership

      3. Assignment Sheet #3 — Prepare Documentation Required for a Loan Application

      4. Assignment Sheet #4 — Explore Problems Faced by Entrepreneurs in Operating a Business

      5. Assignment Sheet #5 — Evaluate Own Potential to Start a Business

   G. Answers to assignment sheets

   H. Test

   I. Answers to test

SUGGESTED ACTIVITIES

II. Instructor's guide

A. Review unit and plan presentation.

B. Obtain materials to supplement unit.

1. *FLM — Decisions in Starting a Retail Business*. FLM Publishers, Inc. Available from Fred L. Moore, 3860 Armer, Boulder, Colorado 80303.

   (NOTE: This classroom simulation activity presents ten different types of stores and requires the students to make management-level decisions on twenty marketing and merchandising activities.)

2. *Small Business Reporter Series*. Bank of America NT & SA, 1976. Available in quantity from Bank of America, Department 3120, P.O. Box 37000, San Francisco, California 94137.

   (NOTE: This series covers fifteen business operations and fifteen business profiles.)

3. Transparencies and competency profiles

   (NOTE: Transparencies and competency profiles for this book are available from the Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074, or from The Associated General Contractors of America, 1957 E Street, N.W., Washington, D.C. 20006; phone 202-393-2040.)

4. Additional resources

   a. Everard, Kenneth E., and Bernard A. Shilt. *Business Principles and Management*. Cincinnati: South-Western Publishing Company, 1979.

   b. Hailes, William D. Jr., and Raymond T. Hubbard. *Small Business Management*. Albany, New York: Delmar Publishers, 1977.

   c. Kirkpatrick, Charles A., and Frederick A. Russ. *Business*. Chicago: Science Research Associates, Inc., 1978.

   d. *SCORE/U.S.*, "Fact Sheet for Local Data." Oklahoma City, Oklahoma: Small Business Administration, n.d.

   e. *Small Business Reporter*, "Financing Small Business." San Francisco: Bank of America, 1976.

   f. *Small Business Reporter*, "Steps to Starting a Business." San Francisco: Bank of America, 1976.

SUGGESTED ACTIVITIES

g. U.S. Small Business Administration. *Presentor's Guide Series: Choosing a Form of Organization for Small Business*. Washington, D.C.: U.S. Government Printing Office, 1980.

h. U.S. Small Business Administration. *Presentor's Guide Series: Location and Layout for Small Business*. Washington, D.C.: U.S. Government Printing Office, 1980.

i. U.S. Small Business Administration. *Presentor's Guide Series: Sources of Assistance and Information for Small Business*. Washington, D.C.: U.S. Government Printing Office, 1980.

j. U.S. Small Business Administration. *Steps to Starting a Business in Oklahoma*. Oklahoma City, Oklahoma: Small Business Administration, n.d.

C. Introduce unit.

(NOTE: This unit has two primary purposes. First, it is intended to help students achieve a realistic idea of the complexity of operating their own businesses by emphasizing that successful business ownership requires skills and knowledge that are just as important to the entrepreneur as skills in the use of tools and knowledge of construction procedures are to the carpenter. Many of your students probably aspire to own their own businesses, and it is important that they realize that they should try to acquire the necessary skills before rushing into business ownership. Secondly, the unit introduces the students to sources of further information and assistance so that they can take steps to acquire necessary entrepreneurship skills. All of your activities in conjunction with teaching this unit should concentrate on helping your students establish realistic viewpoints and on assisting them in understanding their strengths and weaknesses related to running a business.)

SUGGESTIONS:

- Ask the class how many of them intend to start their own business. Have each student describe the business operation he or she has in mind. Use this discussion as an opportunity to point out some of the misconceptions that the class may have.
- Use Monopoly or similar games to discuss the money involved in running a business. Ask the students to discuss how many of them would have the amount of cash that one gets to start such a game; discuss how long such an amount of money might last in setting up a business.
- Make a bulletin board or have the students collect articles on the number of small-business bankruptcies, especially bankruptcies involving carpentry-related businesses.

D. Provide students with unit.

SUGGESTED ACTIVITIES

E. Discuss unit and specific objectives, emphasizing how the objectives relate to your introduction of the unit and your plan of presentation.

F. Discuss information and assignment sheets.

1. Use Information Sheet, Section I to discuss terms associated with starting a small business.

   SUGGESTIONS:

   - Use the terms to make sure that the students know that businesses often operate with borrowed capital and leased facilities and equipment in addition to owned capital.
   - Explain why the word *entrepreneur* is becoming popular, emphasizing that it carries with it the connotation of someone who is dedicated, skilled, and resourceful and industrious enough to make a business a success.

     (NOTE: It is possible that students in your class will be "turned off" by the term *entrepreneur*. If this is the case, do not force it upon them, but do try to use the term in such a way that they accept it as a title of honor or prestige because of the values and characteristics that it presents.)

2. Use Information Sheet, Section II, and Part I of Assignment Sheet #4 to discuss primary factors that contribute to the success or failure of a business.

   SUGGESTIONS:

   - Request information on failure trends in business from the Business Economics Division, Dunn and Bradstreet Corporation, 99 Church Street, New York, New York 10007.
   - Ask a representative of the SBA in your area to discuss the success and failure rates for your area, and the reasons for such.
   - Use Transparencies #1 through #3 to discuss management factors that contribute to the success or failure of a business.
   - Use the FLM materials to acquaint the students with management decisions.
   - Have the students role-play personnel management situations after your discussion of people factors.
   - Invite a panel of entrepreneurs to discuss the factors outlined in Section II. Have the panel discuss how and to what degree their businesses are affected by each factor.

SUGGESTED ACTIVITIES

- Make copies of Supplement #1 and use to discuss market factors and to introduce Section III of the Information Sheet.

3. Use Information Sheet, Section III to discuss sources of information and assistance available to small-business owners.

   SUGGESTIONS:

   - Invite representatives from various agencies to discuss services that their agencies offer.

   - Relate the services of each agency to the factors discussed in Section II.

4. Continue the discussion of sources of help by discussing specific advisors available through the SBA. Use Information Sheet, Section IV.

   SUGGESTIONS:

   - Invite an SBA representative to talk to the class.

   - Invite a panel of entrepreneurs who have used the SBA services to discuss the results of such assistance.

   - Use Assignment Sheet #4 to reinforce the information in Sections II, III, and IV.

5. Use Information Sheet, Section V to discuss sources of capital used by entrepreneurs.

   SUGGESTIONS:

   - Invite an accountant or management consultant to discuss the advantages and disadvantages of each type of capital source.

   - Illustrate your discussion of borrowed capital with Transparencies #4 and #5.

   - Use Assignment Sheets #1 through #3 to reinforce the objective and to prepare students to evaluate their potential to start a business.

     (NOTE: If you are unable to find entrepreneurs who can work with the students on these assignment sheets, or if your students are not prepared to work in the cooperative manner required for these assignment sheets, you may wish to use business profiles from the Bank of America series.)

G. Have interested students complete Assignment Sheet #5.

SUGGESTED ACTIVITIES

SUGGESTIONS:

- Use Supplement #1 to introduce the activity and to relate it to the factors that contribute to the success or failure of a business.
- Have the students discuss with the class the results of their evaluations. Have them examine how their attitudes may have changed from those they held when you first introduced the unit.

H. Give test.

I. Critique test and discuss in class.

J. Reteach and retest if necessary.

K. Counsel each student on his or her potential to start a business, using the test results and Assignment Sheet #5. Emphasize strengths and weaknesses and ways to overcome the weaknesses. Try to get the student to make a realistic assessment of his or her own abilities to start a business, and encourage the student to set up a practical timetable for accomplishing that goal.

L. Complete appropriate section of competency profiles.

III. Unit reference — Lyon, Barbara. *Business Management and Ownership*. Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1982.

SUGGESTED ACTIVITIES

SUPPLEMENT #1 — MARKET FACTOR: WHEN TO TAKE THE RISK

☐ Have you identified the market?

☐ Does there seem to be a market large enough for your business to compete successfully?

☐ Do you know who in your trading area will purchase your goods?

☐ Do you know the income, occupational, and housing patterns of these potential customers?

☐ Do traffic and pedestrian counts give favorable projections for your site?

☐ If your customers will arrive by car, are ample parking areas nearby?

☐ If previous businesses have failed at the site, have you found out why they failed?

☐ Are other stores that handle your type of merchandise prospering in the neighborhood?

☐ Have you come up with a profitable sales estimate?

☐ Does the area have a good safety record?

☐ Is the exterior of your site attractive or can remodeling at reasonable cost improve the exterior image?

☐ Have community business organizations given you a favorable report on the site and business district?

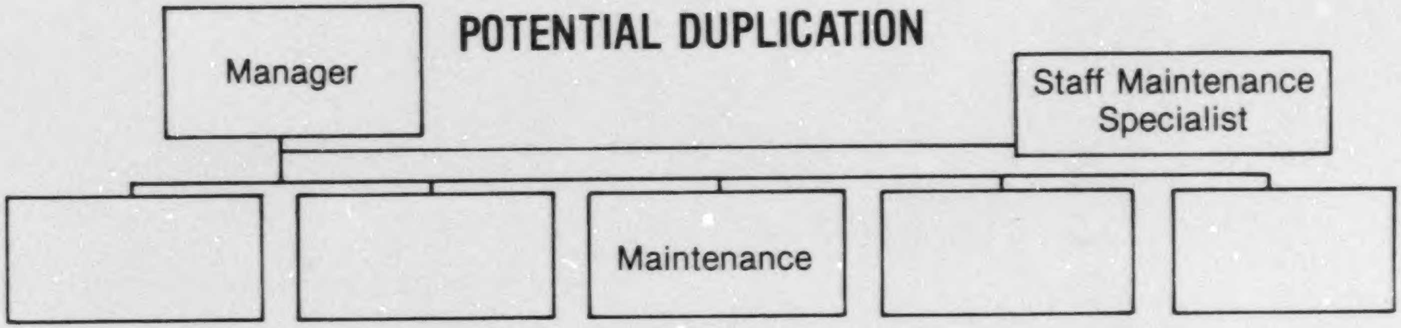
☐ Can you handle the initial investment required to start the business?

☐ Do the terms in your lease offer you protection against possible business failure and rising inflation?

☐ Will you be able to attract employees with the skills needed for your business?

Organizational Plans in Trouble

POTENTIAL DUPLICATION

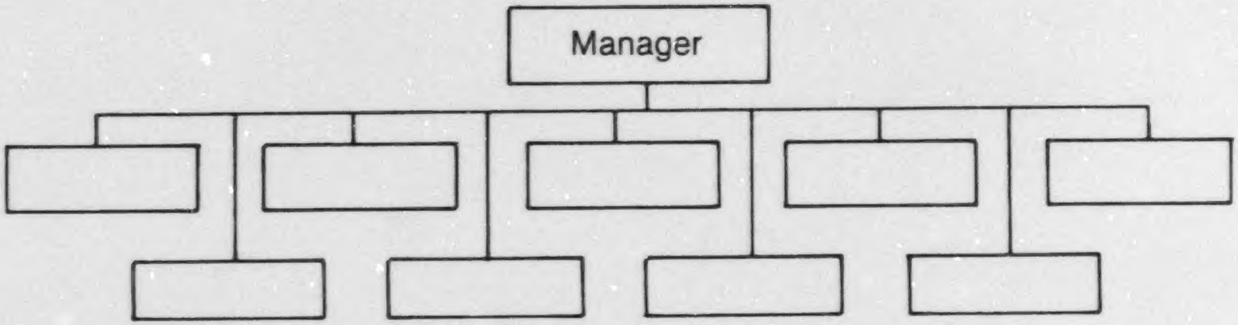


Manager

Staff Maintenance Specialist

Maintenance

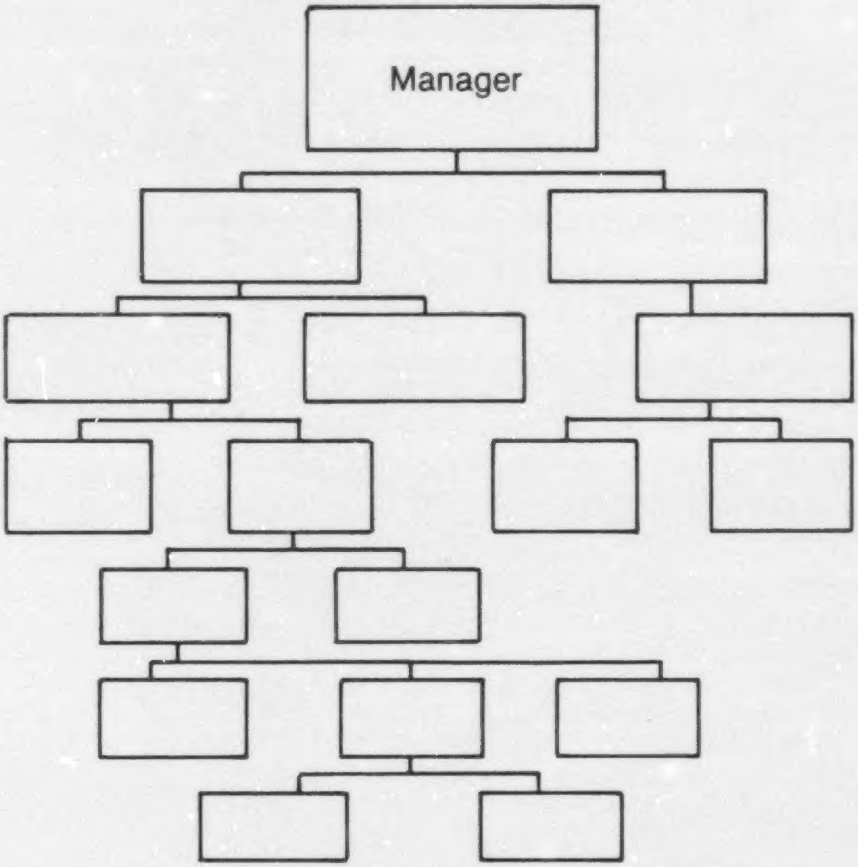
TOO MANY REPORTING TO ONE



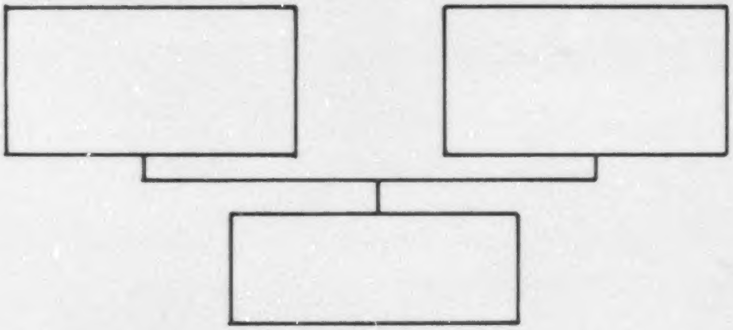
Manager

Organizational Plans in Trouble
(Continued)

TOO MANY LEVELS

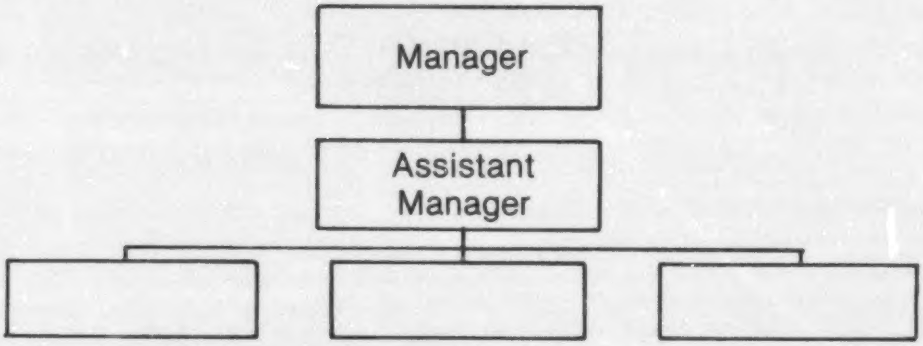


REPORTING TO MORE THAN ONE BOSS



Organizational Plans in Trouble
(Continued)

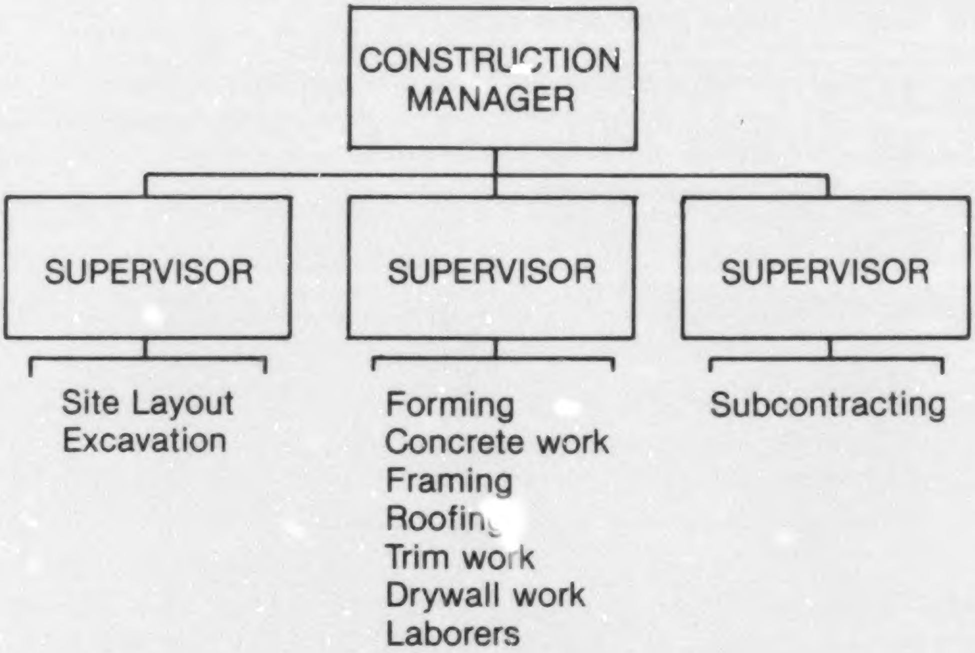
ONE OVER ONE



Manager

Assistant Manager

LOADS OUT OF BALANCE



CONSTRUCTION MANAGER

SUPERVISOR

Site Layout
Excavation

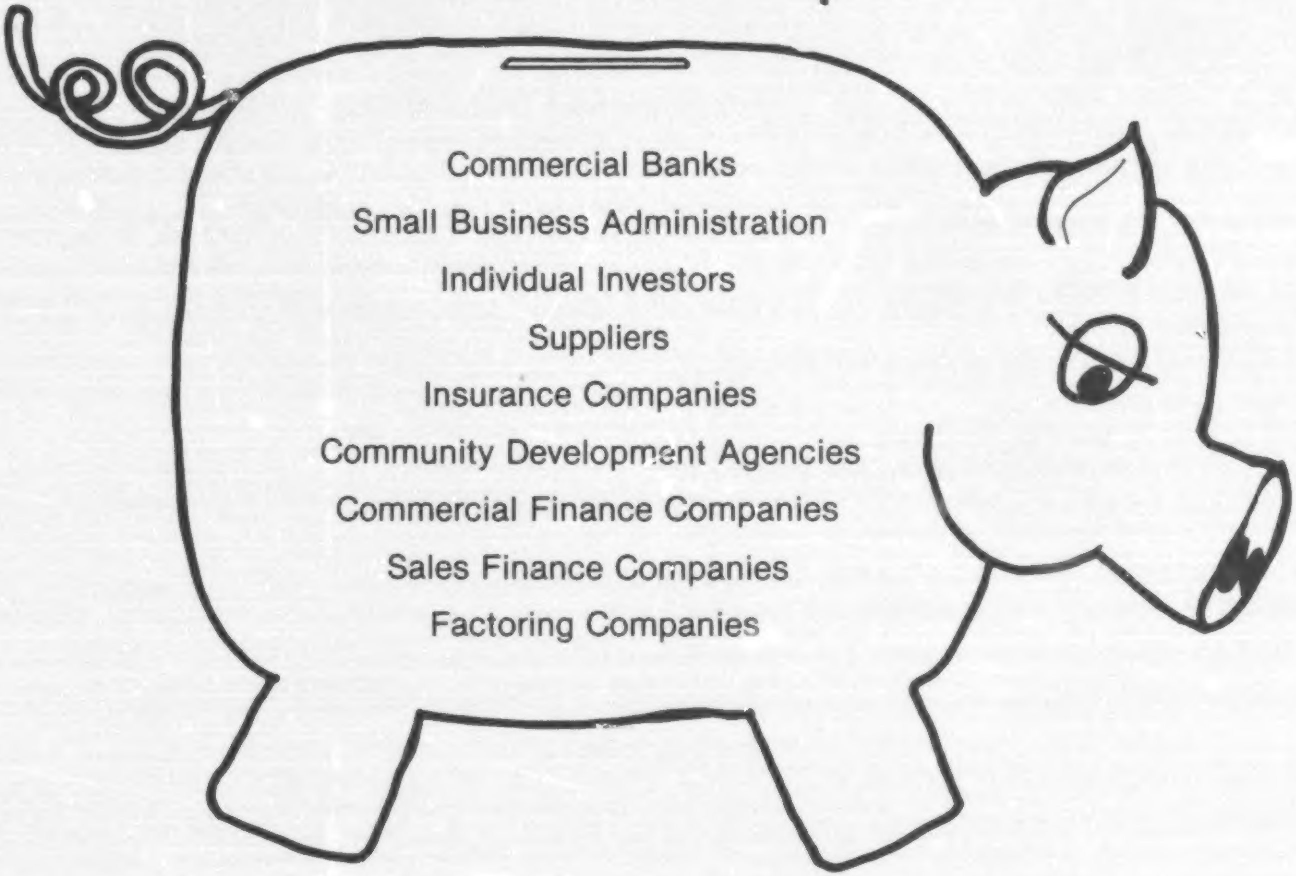
SUPERVISOR

Forming
Concrete work
Framing
Roofing
Trim work
Drywall work
Laborers

SUPERVISOR

Subcontracting

Sources of Borrowing Short-Term Capital



Commercial Banks

Small Business Administration

Individual Investors

Suppliers

Insurance Companies

Community Development Agencies

Commercial Finance Companies

Sales Finance Companies

Factoring Companies

Standards for Small-Business Loans

TYPE OF BUSINESS	ANNUAL SALES	NUMBER OF EMPLOYEES
RETAIL	Not over $2 to $7.5 million, depending on the industry	
SERVICE	Not exceeding $2 million to $8 million, depending on the industry	
WHOLESALING	Not over $9.5 to $22 million, depending on the industry	
MANUFACTURING		Up to 1,500, depending on the industry
GENERAL CONSTRUCTION	Not exceeding $9.5 million for the last three years	
SPECIAL TRADES CONSTRUCTION	Exceeding $1 to $2 million for the last three years, depending on the industry	

STARTING A BUSINESS
UNIT III

INFORMATION SHEET

I. Terms and definitions

A. Small business — Business that is independently owned and not dominant in its field of operation

(NOTE: According to the Small Business Administration, 95 percent of all businesses in the United States are small businesses, primarily in the retailing, wholesaling, construction, and service industries.)

B. Small Business Administration (SBA) — Federal agency established to assist small-business owners

C. Entrepreneur — French word meaning "enterpriser"; a person who owns a business

D. Capital — Money, buildings, machines, and investments that are used or available to make products or to provide services

E. Lease — Contract to use an item without purchasing it

F. Collateral — Personal or business possessions that a borrower assigns to a lender as a pledge of debt payment

EXAMPLES: Tools, machines, building, vehicle(s)

(NOTE: If the borrower does not repay the loan, the lender assumes ownership of the collateral.)

II. Primary factors that contribute to the success or failure of a business

A. Management

(NOTE: Ninety percent of small-business failures result from inexperience or poor management. A number of personal traits affect one's skills as a manager, including the ability to make decisions and give directions, the ability to get along with others, the ability to reorganize and plan, the willingness to take risks, and the ability to bounce back if those risks fail.)

B. People

(NOTE: The success of a business is directly related to the people involved in its operation—not just the management personnel, but the entire staff. People who are skilled, honest, hard-working, and dependable can contribute greatly to the success of a business.)

INFORMATION SHEET

C. Money

(NOTE: The new business owner quickly learns that every aspect of the operation revolves around careful management of the company's finances. Additionally, a company's success or failure depends on economic conditions in its local area and the country. Costs of materials, labor, and facilities and the availability of capital regulate a business' growth and its potential to make a profit.)

D. Market

(NOTE: The success of a business depends on its offering a product that the public wants to buy at the price offered. A carpenter who sets up a cabinet making shop in a locality where all the construction companies build their own cabinets on the job site is likely to have a difficult time succeeding. Other marketing factors are advertising and selling. Good marketing approaches might convince the construction companies that they can get better-quality cabinets at a lower cost and more effectively from the cabinet shop—leading to the success of the business.)

III. Major sources of information and assistance available to small-business owners

(NOTE: Managers of small businesses frequently have had little experience in business management. Yet, because of the limited amount of resources, the success of a small business is generally more directly dependent on the manager making good decisions than it is in a large business where costly mistakes may have less effect on the overall success of the company. Additionally, large companies can afford to hire specialists to handle various phases of their operations, while the small-business owner must make all the decisions and do all the planning. For these reasons, a number of agencies and organizations exist to help the small-business owner.)

A. Federal government agencies

EXAMPLES: Small Business Administration, Department of Commerce, Department of Labor, Federal Trade Commission, Government Printing Office, Internal Revenue Service

B. Chambers of commerce

C. Community business development councils

D. Business or trade associations

EXAMPLES: National Retail Merchants Association, National Federation of Independent Business, The Associated General Contractors of America, National Association of Home Builders

E. Credit bureaus

INFORMATION SHEET

F. Better business bureaus

G. Associations of business people

EXAMPLES: Rotary, Kiwanis, Association of Sales and Marketing Executives

H. Special libraries and information centers

I. Business professionals

EXAMPLES: Bankers, management consultants, Service Corps of Retired Executives, accountants, lawyers, insurance agents

J. Personal contacts

EXAMPLES: Other business people, customers, suppliers

IV. Advisors available from the Small Business Administration

A. Management consultants

(NOTE: SBA management consultants offer advice on the kind of business to start, where financing may be available, how to obtain helpful training, and how to find solutions for management problems.

B. Loan administrators

(NOTE: The SBA makes loans for purchasing equipment and facilities, buying materials, and meeting other expenses related to starting a business.)

C. Contract locators

(NOTE: Contract locators assist small businesses in finding bid information on government contracts and in writing bids to get such contracts.)

V. Sources of capital used by entrepreneurs

(NOTE: *Capital* is the money required to operate a business. Expenses may be *fixed capital* or *working capital* expenses. Fixed capital expenses include money spent to buy tools, buildings, vehicles, and equipment. Working capital expenses consist of salaries, money spent to rent or lease equipment, taxes, insurance costs, and advertising.)

A. Owned capital — Money belonging to the entrepreneur

EXAMPLES: Personal savings, mortgages on personal property

B. Retained earnings -- Company profits used to expand the company

INFORMATION SHEET

C. Borrowed capital — Money obtained from lenders such as individual investors, banks, finance companies, and the SBA

(NOTE: Loans may be *short-term* or *long-term*, depending on the amount of time allowed for repayment. Short-term loans are generally repaid over a period of a month to a few years. Long-term loans may be repaid over a period of ten to thirty years or more.)

STARTING A BUSINESS
UNIT III

ASSIGNMENT SHEET #1 — EXAMINE EXPENSES INVOLVED IN STARTING A BUSINESS

NAME ______________________________ SCORE ______________

Many carpenters go into business for themselves. A carpenter may accept a subcontract to do work on a project, may act as the primary contractor, may build structures without a contract and hope to sell the buildings, or may start a company in a related area such as construction equipment or building materials. With all these opportunities, many carpenters are tempted to start their own businesses early in their careers without realizing the kinds of expenses and problems that an entrepreneur may encounter.

This assignment sheet provides you with the opportunity to study two businesses in the field of carpentry to become acquainted with the expenses involved in such businesses. Your instructor may ask you to complete one or both of these studies, and will help you obtain the resources necessary to complete this assignment.

PART I — Building a House on Speculation

A. You have decided that you would like to build houses on your own and try to sell them to individuals. This is called *building on speculation*, and such houses are called *speculative* or *spec houses*. You have chosen the floor plan at the end of this assignment sheet because it seems to fit the needs of the buying public in your area. Your next task is to locate a lot on which you can build the home. Study the house plan and determine the requirements and restrictions for a building site. Then locate a suitable lot in your area. Once you have found a lot, answer the following questions.

1. Where is the lot located? ______________________________

2. What is the price of the lot? ______________________________

3. Does the house plan fit the restrictions for development on the lot? ______________

(NOTE: Various restrictions may be placed on a house before it can be built on a particular site. The house may have a size requirement—minimum, maximum, or both. There may be requirements about the design of the house, such as a two-story, a ranch-style, a minimum number of bedrooms, a wood shingle roof, or a finish material such as stone or brick. A restriction may be placed on the minimum or maximum selling price. The contractor is responsible for being aware of these restrictions and following them; therefore, you may have to complete other parts of this assignment sheet before you can answer this question. For example, you may have to estimate the selling price if such a restriction exists on the lot you have chosen.)

ASSIGNMENT SHEET #1

4. Are there other requirements that will affect the suitability of this lot for your purposes? For example, do you have to start or finish the house within a certain time period? List any such requirements below.

B. When building a spec house, you will have to buy and pay for the materials used in constructing the house. These can cost several thousands of dollars. Although materials suppliers will often sell materials on credit, they frequently expect payment in full within thirty days. Thus, it is often necessary to borrow money to purchase the materials, meaning that the interest charges will add to the expenses of the materials. Study the materials list at the end of this assignment sheet, and then obtain estimates on the costs of the materials. Do not hesitate to shop around for the best prices and payment terms; remember that you have to be concerned with showing a profit.

(NOTE: Be sure to modify the materials list to conform to any local building codes or restrictions on the building site. If you are familiar with estimating procedures, you may want to create your own materials list for the building methods that you would use.)

1. What is the total cost of materials for the house?____________________

2. What kind of credit and financing plans are available from the suppliers you contacted?

3. Often suppliers will offer discounts for large purchases. Were there discounts available from the suppliers you contacted? If so, what kind?

ASSIGNMENT SHEET #1

4. If you have to borrow money to buy the materials, you will be paying interest on the loan until you can pay it back. For that reason, some contractors do not borrow the money they need to purchase specific materials until they are ready to use them. For example, it may take two months from the start of the project until you are ready to hang the drywall. Rather than pay interest on the drywall for two months, you might want to wait to buy the drywall, even if the purchase of all the materials together would entitle you to a discount from the supplier. On the other hand, the costs of building materials fluctuate throughout the year and in another two months the cost may be higher or lower than the price quoted to you now. Thus, it might be a good idea to purchase some material now, if the price is low, even if you will not be ready to use it for a few weeks. Consider the prices you have obtained, interest rates, discounts, and the period that you are likely to have to carry the loan. Discuss what you consider to be the best plan for purchasing materials.

   ____

   ____

   ____

   ____

   ____

C. Another expense in building a house is the labor. You will not be able to do the entire project by yourself—at least not in a reasonable time. You have two basic choices for getting the work done. You can hire workers as employees of your business, or you can contract with other businesses or individuals to provide the labor at an agreed cost. If you hire people to work for your business, you assume certain responsibilities (providing the employees with sufficient work and providing them with benefits such as insurance, worker's compensation, and a retirement plan), all of which cost you money. Additionally, you may have to provide tools and equipment that would otherwise be provided by the other company if you contracted the work. Both choices have advantages and disadvantages, and many enterpreneurs use a combination of the two, hiring workers for some tasks and contracting out other jobs. There are several things for you to consider before deciding what is right for you. Answering the following questions will help you to make that decision.

1. Contact some contractors to get bids on various phases of the house you are planning. Write the bids in the spaces provided.

   (NOTE: In contracting services, there are many variables that can save you money or cost you time and money. Some things to consider include whether you or the contractor provides the materials. Sometimes a specialty contractor, such as a heating and air-conditioning contractor, can provide you with heating and cooling systems less expensively than you can obtain them from a supplier. You should also consider the warranty the contractor offers on the work and what kind of payment terms are required by the contract.)

   ____________a. Excavation and foundation contractor

ASSIGNMENT SHEET #1

_____________b. Framing contractor

_____________c. Roofing contractor

_____________d. Plumbing contractor

_____________e. Heating and air-conditioning contractor

_____________f. Electrical contractor

_____________g. Drywall hangers and tapers

_____________h. Trim and cabinet contractor

_____________i. Painters

_____________j. Flooring and other specialties (carpet, tile, counter tops)

_____________k. Brick and masonry contractor

_____________l. Landscaping contractor

_____________m. Others

2. When estimating the cost of hiring workers to be employees of your company, talk to contractors to get some idea about the costs associated with hiring workers. List the expenses below.

a. Typical hourly wages

_____________ 1) Frame carpenter
_____________ 2) Laborer
_____________ 3) Trim carpenter
_____________ 4) Roofer
_____________ 5) Plumber
_____________ 6) Electrician
_____________ 7) Bricklayer
_____________ 8) Concrete finisher
_____________ 9) Backhoe operator
_____________10) Tile setter

b. Equipment costs (purchase, lease, or hire)

_____________ 1) Scaffolding
_____________ 2) Mortar mixer
_____________ 3) Pneumatic stapler
_____________ 4) Radial arm saw
_____________ 5) Bulldozer

c. Benefit costs for a frame carpenter at the wages above

_____________ 1) Worker's compensation
_____________ 2) Health insurance

ASSIGNMENT SHEET #1

_____________ 3) Other insurance (life, liability, etc.)
_____________ 4) Retirement
_____________ 5) Vacation and sick leave

(NOTE: Determine the approximate cost of a day of sick leave or vacation time by multiplying the hourly wage by eight hours.)

_____________ 6) Other benefits

3. Considering the costs of contracting labor and of hiring employees, what do you think is the best method for getting the labor done for your project, and how much will that method cost?

____

____

____

____

D. You should now have some idea of what it would cost and what resources would be necessary for you to build a spec house. You should have decided on the approach you would use in acquiring materials and labor. The next big decision concerns the financing of the project. In a later assignment sheet you will have an opportunity to prepare a financial statement and other documents that will be required to apply for a loan. Right now, you need only consider financing in a general way by studying your answers to the following items.

1. What will be your total cost for the lot and the labor and materials to build the house?

____

2. Approximately how long will it take to complete construction of the house under ideal conditions—that is, good weather, low employee absenteeism, ready availability of contractors, no materials delays?

____

3. What would be a reasonable selling price for the house, considering its size, features, costs to you, location, and your need to make a profit?

____

4. What is the average length of time that a comparable house is on the market in your area?

____

5. How much of the cost of the project would you have to finance with a bank or other institution?

____

ASSIGNMENT SHEET #1

6. What would be the terms of such a loan?

_____________a. Interest rate?

_____________b. Monthly payment?

_____________c. Payback period?

7. The majority of your monthly loan payment will be a finance charge—especially in the early payment period—and each payment will reduce the amount you owe by only a very little amount. If possible, get a payment schedule showing the amount of interest paid each month. Using the schedule, compute how much your profit will be reduced if you are unable to sell the house for

_____________a. one month.

_____________b. two months.

_____________c. three months.

_____________d. six months.

_____________e. eigtheen months.

_____________f. one year.

8. List other expenses you may have.

_____________a. Closing costs

_____________b. Taxes

_____________c. Legal fees

_____________d. Advertising

_____________e. Others___________

PART II — Operating a Lumberyard

A. You have decided that you would like to start a retail business to sell building materials. One of your first needs is to find a location for your business, and you may have several choices of facilities. For example, you may be able to rent or lease an existing lumberyard or you may be able to buy an existing lumberyard, with or without merchandise. Another possibility is that you can find some land on which you can build a lumberyard. Frequently, undeveloped land is available for sale or for lease, with the owner willing to build facilities to suit the buyer or lessee. Of course, in choosing any site you will also have to consider whether the location is zoned for the business that you are planning and whether it is a good location in terms of attracting customers and receiving deliveries from suppliers. Check with existing lumberyards and with real estate agents to find a suitable location for your business so that you can answer the following questions.

1. What locations are available to you? Check those available.

☐ Existing lumberyards for sale

☐ Existing lumberyard for rent or lease

☐ Building site for sale

☐ Building site for rent or lease

ASSIGNMENT SHEET #1

2. What would be the approximate cost of buying an existing lumberyard or building your own facilities?

   Total cost ______________________________

   Approximate monthly payments ______________________________

3. What would be the cost of renting or leasing a location complete with necessary facilities, either existing or built to suit your needs?

   Monthly cost to rent or lease ______________________________

4. Will you be able to support yourself while waiting for facilities to be built or readied for business? Explain.

   ____

5. Considering your answers to the preceding questions, what would be your choice of locations for your lumberyard? Why?

   ____

   ____

B. Now that you have some idea of the lumberyards available in your area, and the options for locations and their costs, your next step might be to contact the Small Business Administration for some help and information. The SBA can discuss your plans and advise you as to whether the idea is worth trying and how you should approach the business. Contact your local SBA or a similar organization to discuss starting a building materials business in the locations you have considered. You might want to answer some of the following questions during your discussion.

__________ 1. How many businesses sell lumber in your marketing area?

__________ 2. Would your plans increase that number or leave it unchanged—that is, will you be replacing one of the businesses by renting or buying its facilities?

__________ 3. What is the total dollar value of sales made by all such businesses in your area per year? Per month?

__________ 4. Assuming that all other things were equal, what would be the proportional amount of business that you could expect to attract each month?

__________ 5. What would be the approximate cost of merchandise needed to start the business?

__________ 6. How much would have to be paid toward the merchandise during the first three months of business?

(NOTE: A number of materials suppliers will deliver the materials and bill you later. In this way, you may have thirty days or more before you have to pay for any merchandise.)

ASSIGNMENT SHEET #1

7. What other expenses are likely? How much would they run per month?

____________ a. Salaries and benefits

____________ b. Utilities

____________ c. Advertising

____________ d. Office supplies

____________ e. Dues (trade associations, chamber of) commerce)

____________ f. Taxes

____________ g. Insurance

____________ h. Equipment

____________ i. Professional services (legal, accounting)

____________ j. Facilities maintenance

____________ k. Other — ____

____

8. In light of monthly expenses, your realistic expectation of income, and your need to make some profit, is it a good idea to start a lumberyard in the location you have chosen or in your area at all? Why?

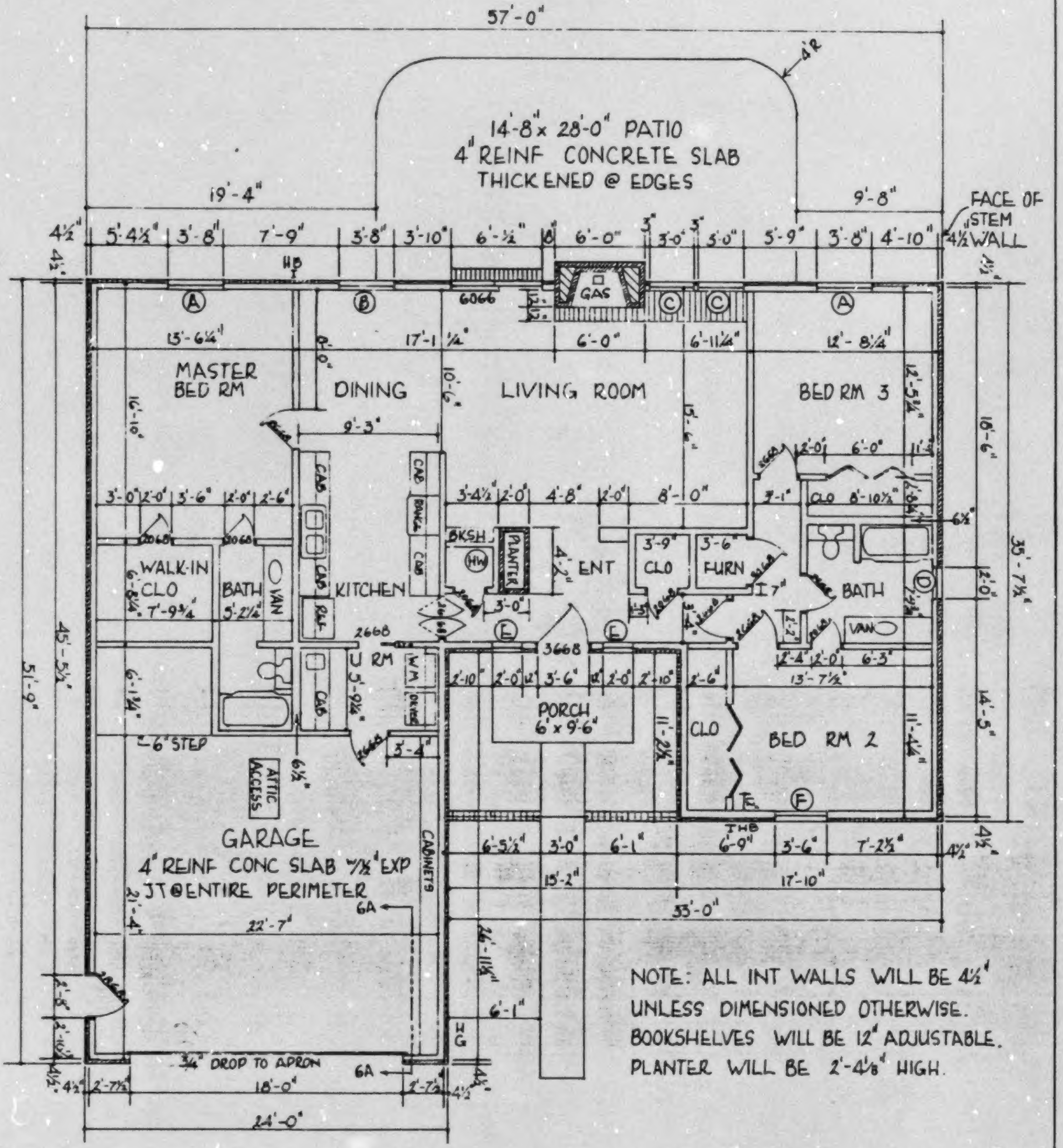
____

____

9. Are other carpentry-related businesses good choices? If so, what and why?

____

____


57'-0"
4'R
14'-8" x 28'-0" PATIO
4" REINF CONCRETE SLAB
THICKENED @ EDGES
19'-4"
9'-8"
FACE OF STEM WALL
4½"
5'-4½"
3'-8"
7'-9"
3'-8"
3'-10"
6'-½"
6'-0"
3'-0"
3'-0"
5'-9"
3'-8"
4'-10"
4½"
HB
6066
GAS
A
B
C
C
A
15'-6¼"
17'-1½"
6'-0"
6'-11¼"
12'-8¼"
MASTER BED RM
DINING
LIVING ROOM
BED RM 3
16'-10"
10'-6"
13'-6"
12'-5¾"
9'-3"
2'-0"
6'-0"
3'-0"
2'-0"
3'-6"
2'-0"
2'-6"
3'-4½"
2'-0"
4'-8"
2'-0"
8'-10"
7'-1"
CLO
8'-10½"
6½"
CAB
BOOKS
2068
2068
WALK-IN CLO
7'-9¾"
BATH
5'-2½"
VAN
KITCHEN
REF
BKSH
HW
PLANTER
4'-2"
ENT
3'-9"
CLO
3'-6"
FURN
BATH
VAN
D
2'-0"
3'-0"
E
E
3668
2668
U RM
5'-9¾"
W
D
2'-4"
2'-0"
6'-3"
13'-7½"
2'-10"
2'-0"
3'-6"
2'-0"
2'-10"
2'-6"
PORCH
6' x 9'-6"
11'-2½"
CLO
BED RM 2
11'-4¼"
F
6'-1¾"
6" STEP
ATTIC ACCESS
3'-4"
6½"
GARAGE
4" REINF CONC SLAB ½" EXP
JT @ ENTIRE PERIMETER
CABINETS
6A
22'-7"
21'-4"
24'-11¾"
6'-1"
HB
THB
6'-5½"
3'-0"
6'-1"
6'-9"
3'-6"
7'-2½"
4½"
15'-2"
17'-10"
33'-0"
18'-6"
35'-7½"
14'-5"
45'-5½"
51'-9"
2'-8"
2'-10"
¾" DROP TO APRON
6A
4½"
2'-7½"
18'-0"
2'-7½"
24'-0"

NOTE: ALL INT WALLS WILL BE 4½" UNLESS DIMENSIONED OTHERWISE.
BOOKSHELVES WILL BE 12" ADJUSTABLE.
PLANTER WILL BE 2'-4⅛" HIGH.

FLOOR PLAN

SCALE :- ⅛" = 1'-0"

FC - 113-A

BEST COPY AVAILABLE

ASSIGNMENT SHEET #1

MATERIALS LIST

Item	Quantity	Cost	Total
Concrete (poured slab)			
CD plywood, ½"	10 shts	____	____
2×4 utility	160 bd ft	____	____
#5 rebar	1400 ft	____	____
Pins, 24"	220	____	____
Wire mesh, 6–6 × 10–10	4 rolls	____	____
Concrete	50 cu yds	____	____
Anchor bolts, ½" × 8"	30	____	____
Dimensional lumber			
Precut studs	400	____	____
2×4	800 bd ft	____	____
2×6	78 bd ft	____	____
2×10	20 bd ft	____	____
2×12	36 bd ft	____	____
#12 white pine 1×12	240 bd ft	____	____
#2 white pine 1×12	50 bd ft	____	____
AB plywood, ¾"	4 shts	____	____
LC ash, ½"	4 shts	____	____
FC ash, ½"	6 shts	____	____
AD plywood			
4' × 8' ×½"	6 shts	____	____
4' × 8' ×¼"	13 shts	____	____
Roofing			
Trusses			
23'	13	____	____
23' gable end	1	____	____
18'	6	____	____
18' gable end	1	____	____
23'–10"	28	____	____
23'–10" gable end	2	____	____
2×8	270 bd ft	____	____
CD plywood			
4' × 8' ×½"	93 shts	____	____
Plywood clips	1 box	____	____
Felt paper, 30#	8 rolls	____	____
Asphalt shingles	30 sqs	____	____
Flashing, 12"	100 ft	____	____
Exterior			
Cedar plywood			
4' × 8" × ½"	12 shts	____	____
#2 rough cedar 1×12	80 bd ft	____	____
Bricks	6000	____	____
Screen mold	500 Ln ft	____	____
Brick mold	150 Ln ft	____	____

Item	Quantity	Cost	Total
Drywall			
4' × 8' ×½"	170 shts	____	____
Tape	4 rolls	____	____
Filler	5 gal	____	____
Windows (double-glass aluminum)			
Double-hung			
3'–8" × 3'–0" 4-light	2	____	____
3'–8" × 5'–0" 4-light	1	____	____
2'–0" × 3'–0" 4-light	1	____	____
3'–8" × 5'–0" 16-light	1	____	____
Fixed			
3'–0" × 5'–0" single-light	2	____	____
2'–0" × 6'–0" 20-light	2	____	____
Trim			
Doors (ash unless indicated otherwise)			
2068 1⅜" HC	5	____	____
2468 1⅜" HC	1	____	____
2668 1⅜" HC	6	____	____
3068 1¾" SC	1	____	____
3668 1¾" SC	1	____	____
2668 Cafe	1 pr	____	____
2668 Pocket	1	____	____
2668 1¾" Metal fireproof	1	____	____
6068 Bifold, 1¼"	2 sets	____	____
6068 Sliding patio, aluminum	1	____	____
1956 Shower, frosted glass	2 sets	____	____
Thresholds, 1" Alum	3	____	____
Hinge sets 3½" × 3½"	12	____	____
Hinge sets 4" × 4"	3	____	____
Interior jamb sets and stop	17	____	____
Exterior jambs	4	____	____
Base	500 Ln ft	____	____
Locksets			
Entry	3	____	____
Privacy	6	____	____
Closet	5	____	____
Drawer guides	22	____	____
Drawer pulls	22	____	____
Cabinet pulls	24	____	____
Cabinet hinge sets	24 pr	____	____
Attic ladder pulldown	1	____	____
Garage door, 7' × 18'	1	____	____

ASSIGNMENT SHEET #1

Item	Quantity	Cost	Total	Contract bid
Trim (cont'd)				
Spindles, 3" × 30"	3	____	____	
Laminate				
Butcher block	50 sq ft	____	____	
Marble	30 sq ft	____	____	
Stove top	1	____	____	
Oven	1	____	____	
Garage door opener	1	____	____	
Other (contracted)				
Guttering				____________
Plumbing (including all fixtures and disposer)				____________
Heating and air conditioning (including units, vents, etc.)				____________
Electrical (including outlets, plates, fixtures, etc.)				____________
Painting and staining				____________
Carpeting and flooring (including materials and installation)				____________
Masonry work				____________

(NOTE: Other materials may be provided by the builder or the subcontractors. For example, the drywall work might be contracted. The drywall subcontractor would probably furnish the tape, plaster, nails, and corners. A roofer might furnish the staples if using a pneumatic stapler. This listing is intended to give you some idea of the cost of materials and is not intended to be an exact itemization of the materials needed to construct the plan shown. The true amount of materials will vary with construction techniques, grades of materials, owner's, desires, and other factors.)

STARTING A BUSINESS
UNIT III

ASSIGNMENT SHEET #2 — WRITE A PLAN FOR SMALL-BUSINESS OWNERSHIP

NAME ____ SCORE ________________

Few people are able to start a business without receiving financial assistance. Such assistance may come from established lending institutions such as banks and and savings and loan associations, from friends or relatives, or from other individuals who invest in the company. One of the most important steps in securing financial assistance is the business plan. Basically, the business plan explains what the business does, how it operates, and why the business deserves the loan or deserves to be considered as a business investment. The entrepreneur uses the business plan to interest potential lenders or investors in providing financial assistance.

In this assignment sheet, you will work with business people to write a plan for small business ownership. Your plan will be based on your work on Assignment Sheet #1 or on the business person's actual business. If possible, you will consider real needs of that person's business, such as expansion of facilities, purchasing a large piece of equipment, or improving service capabilities. The figures and information that you will be using are realistic enough to make this exercise valuable to you, but they may not reflect the exact operation and financial status of the business. In any event, you should be considerate of the business person with whom you work, and treat the information with all seriousness and confidentiality.

Below is an outline of the kind of information that might be contained in a business plan.

Sample Business Plan Outline

I. Cover letter
  A. Dollar amount requested
  B. Terms and timing
  C. Type and price of securities
II. Summary
  A. Business description
    1. Name
    2. Location and plant description
    3. Product
    4. Market and competition
    5. Management expertise
  B. Business goals
  C. Summary of financial needs and application of funds
  D. Earnings projections and potential return to investors
III. Market analysis
  A. Description of total market
  B. Industry trends
  C. Target market
  D. Competition
IV. Products or services
  A. Description of product line
  B. Proprietary position: patents, copyrights, and legal and technical considerations
  C. Comparison to competitors' products
V. Manufacturing process (if applicable)
  A. Materials
  B. Sources of supply
  C. Production methods
VI. Marketing strategy
  A. Overall strategy
  B. Pricing policy
  C. Sales terms
  D. Method of selling, distributing, and servicing products
VII. Management plan
  A. Form of business organization
  B. Board of directors composition
  C. Officers: organization chart and responsibilities
  D. Résumés of key personnel
  E. Staffing plan/number of employees
  F. Facilities plan/planned capital improvements
  G. Operating plan/schedule of upcoming work for next one to two years
VIII. Financial data
  A. Financial history (five years to present)
  B. Five-year financial projections (first year by quarters; remaining years annually)
    1. Profit and loss statements
    2. Balance sheets
    3. Cash-flow chart
    4. Capital-expenditure estimates
  C. Explanation for projections
  D. Key business ratios
  E. Explanation of use and effect of new funds
  F. Potential return to investors; comparison to average return in the industry as a whole

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ASSIGNMENT SHEET #2

A. Cover letter

1. Discuss the amount of money that will be necessary for the required project.
2. Discuss the terms and timing of a loan for that amount.
3. Ask the business person to explain securities to you and what kind of securities will be required for the loan.

B. Summary

1. Work with the business person to put together a description of the business.
   a. Name of business — ____________________
   b. Location — ____________________
   c. Product or service — ____________________
   d. Potential for profit in light of the market and the competition — ____________________
   ____
   e. Management experience and expertise — ____________________
   ____
2. Ask the business person to explain the business' goals to you.
3. Discuss why money should be borrowed for this project and why this approach is the best way to acquire the funds.
4. Discuss how this project can help increase the business' earnings and why that will be beneficial to investors.

C. Market analysis

1. Discuss how the business fits into the total market for this product or service in your area.
2. Discuss whether the need for the product or service is growing or declining in your area.
3. Have the business person describe the business' typical customers.
4. Weigh the business' strengths and weaknesses in comparison to other businesses offering the same product or service.

ASSIGNMENT SHEET #2

D. Products or services

1. Discuss specific products and services offered by the business.

2. Discuss any proprietary positions that the business might have, such as exclusive distributorships or exclusive services.

3. Weigh the strengths and weaknesses of the business' products and services in comparison to those of competitors.

E. Marketing strategy

1. Discuss the types of advertising and marketing approaches used by the business.

2. Discuss how the business arrives at prices and how much profit it expects to make, overall and on individual products and services.

3. Examine the terms of sales, including means of checking credit, whether financing is made by the business or a third party, whether revolving accounts and layaway plans are available, what warranties are offered, and collection procedures.

4. Discuss the business' methods of selling and distributing products and services—that is, are all sales made in a store or do they have field representatives; do they deliver products; if offering a service, do they restrict the distance they are willing to travel to perform the service; are the costs of some services passed on to the customer?

F. Management plan

1. Ask how the business is organized; for example, is it owned by one person, a partnership, a corporation?

2. If the business has a board of directors, ask the business person to explain the roles and backgrounds of board members.

3. Discuss the structure of the organization and the responsibilities of the people within this structure.

4. Discuss the background and qualifications of key personnel.

   (NOTE: As you discuss the staffing of the organization, compare your training, background, and management qualities to those being discussed so that you may form a realistic idea of how you compare to people who are actually serving in roles that you may want to try someday, such as being the owner of a small business or the manager of a larger one.)

5. Discuss the number of employees and their jobs; pay particular attention to how the number of employees or their duties may have changed in the past few years.

ASSIGNMENT SHEET #2

6. Discuss the business' facilities and how these facilities may have changed or may need to be changed.

7. Ask the business person to describe to you any future plans or goals that the business may have for growth or expansion of services.

G. Financial data

(NOTE: Remember that you will be working with realistic figures even if they are not the actual financial data of the business. Even approximate figures should be treated with respect and confidence.)

1. Discuss the business' financial growth or decline over the past five years.

2. Discuss the potential for financial growth or decline over the next five years, including

    a. probable profit and loss;

    b. planned equipment and inventory balances;

    c. methods used to ensure that income is generated and capital is properly spent;

    (NOTE: The transfer of money between and among businesses and individuals is called *cash flow*.)

    d. planned spending for expansion, new equipment and facilities, etc.

3. Discuss the system that the business person uses to estimate future income and expenses.

4. Have the business person explain any formulas or ratios used in financial planning, such as a percentage of profit for expansion or employee profit-sharing, a percentage of gross income for advertising and marketing, etc.

5. If the business person is planning to borrow money, ask how the money will benefit the business; otherwise, ask ways in which the business could benefit if it were to borrow money for some purpose.

6. Ask how the improvements to the business from the borrowed money will improve the business' ability to compete in the market and how customers and investors will benefit.

STARTING A BUSINESS
UNIT III

ASSIGNMENT SHEET #3 — PREPARE DOCUMENTATION REQUIRED FOR A LOAN APPLICATION

NAME ______________________________ SCORE ______________

Most entrepreneurs are unable to start their businesses without receiving some financial assistance. Often the loan comes from friends or relatives, but in most cases the necessary money comes from a bank or other commercial lending institution. These lending institutions are businesses too and must be careful with their resources in order to stay in operation. For that reason, lenders require borrowers to provide detailed information about how the money is to be used and proof that the borrower can repay the loan. Although the exact requirements will vary from institution to institution, and with the purpose and amount of the loan, the example below shows a typical outline of the types of documents that might be required.

Sample Loan Package Outline

I. Summary
  - A. Nature of business
  - B. Amount and purpose of loan
  - C. Repayment terms
  - D. Equity share of borrower (debt/equity ratio after loan)
  - E. Security or collateral (listed with market value estimates and quotes on cost of equipment to be purchased with the loan proceeds)

II. Personal information (on all corporate officers, directors, and any individuals owning 20 percent or more of the business)
  - A. Education, work history, and business experience
  - B. Credit references
  - C. Income tax statements (last three years)
  - D. Financial statement (not over sixty days old)

III. Business information (whichever is applicable below—A, B, or C)
  - A. New business
    - 1. Business plan
    - 2. Life and casualty insurance coverage
    - 3. Lease agreement
    - 4. Partnership, corporation, or franchise papers, if applicable
  - B. Business acquisition (buyout)
    - 1. Information on acquisition
      - a. Business history (include seller's name, reasons for sale)
      - b. Current balance sheet (not over sixty days old)
      - c. Current profit and loss statements (preferably less than sixty days old)
      - d. Business' federal income tax returns (past three to five years)
      - e. Cash-flow statements for last year
      - f. Copy of sales agreement with breakdown of inventory, fixtures, equipment, licenses, goodwill, and other costs
      - g. Description and dates of permits already acquired
      - h. Lease agreement
    - 2. Business plan
    - 3. Life and casualty insurance
  - C. Existing business expansion
    - 1. Information on existing business
      - a. Business history
      - b. Current balance sheet (not more than sixty days old)
      - c. Current profit and loss statements (not more than sixty days old)
      - d. Cash-flow statements for last year
      - e. Federal income tax returns for past three to five years
      - f. Lease agreement and permit data
    - 2. Business plan
    - 3. Life and casualty insurance
    - 4. Partnership, corporation, or franchise papers, if applicable

IV. Projections
  - A. Profit and loss projection (monthly, for one year) and explanation of projections
  - B. Cash-flow projection (monthly, for one year) and explanation of projections
  - C. Projected balance sheet (one year after loan) and explanation of projections

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ASSIGNMENT SHEET #3

In this assignment sheet you will prepare the documents necessary to apply for a loan to start a business. Use the information you gathered in Assignment Sheet #1 when preparing the documents. Be realistic with your information, even if you have to guess at much of it. Your instructor will evaluate your work, using standards used by commercial lenders, or will invite staff members from the SBA or lending institutions to evaluate your work as if it were a real loan application.

Complete each section of the assignment sheet that applies to your situation. Samples of each document can be found at the end of this assignment sheet.

A. Summary

1. Nature of business

   a. Business name ______________________________

   b. Location of head office ______________________________

   c. Services and products offered ______________________________

   ____

2. Amount requested ______________________________

3. Purpose of loan ______________________________

4. Repayment terms

   a. Size of monthly payment desired ______________________________

   b. Time required to repay loan ______________________________

4. How much of your own money has been put into the business or will be put into the business compared to the total value of the business?

   ____

   (NOTE: The investment of your own money determines how much of the business you own outright and is called your *equity* in the business.)

5. What security or collateral are you offering for the loan?

   ____

   (NOTE: The borrower of a large loan is required to offer security that the loan will be repaid. Generally, the security is in the form of agreeing to give the lender something of value if the borrower is unable to repay the loan. For example, if you borrow money from a bank to buy a truck but fail to make the required payments, the bank may take possession of the truck.)

ASSIGNMENT SHEET #3

B. Personal information

1. List any schools attended (including trade schools) and degrees received.

		Dates		
School	Location	From	To	Degrees

2. List your employment for the past five years, beginning with your present or most recent job.

				Dates	
Employer	Address	Supervisor	Your Title	From	To

3. Attach income tax statements for the past three years and a financial statement no older than sixty days.

(NOTE: The income tax statements and financial statements are typical of documents requested by lenders. Do not attach your own income tax statements or financial statements to this assignment sheet. You will not be required to show these documents to your instructor. However, if you choose to share the information with a loan officer from a lending institution or if you seriously wish to assess your eligibility for a loan, you may wish to have such documents available when you meet with the loan officer.)

C. Business information

(NOTE: Entrepreneurs generally apply for one of three kinds of business loans. They may borrow money to start a new business or to expand a business that they are already managing or they may borrow money to purchase an existing business. Each of these purposes requires slightly different documentation. For this assignment sheet, you will probably be applying for money to start a new business or to buy an existing one. If you are starting a new business, complete the information in item 1. If you are trying to buy an existing business, skip item 1 and go to item 2.)

ASSIGNMENT SHEET #3

1. New business

   a. Describe your business plan. You should discuss your facilities and location, hours, staffing, sales techniques, methods of purchasing, and other information that will show that you are knowledgeable of business practices and that you are working to make a profit.

   ____
   ____
   ____
   ____
   ____
   ____
   ____

   b. List any life or casualty insurance coverage you have that will be connected with the business.

   ____
   ____

   c. What are the terms of any lease agreements connected with the business (facilities, equipment, etc.)?

   ____
   ____
   ____

2. Existing business acquisition

   a. Give a brief history of the business, including the owner's name and the reason for the sale.

   ____
   ____
   ____
   ____
   ____

ASSIGNMENT SHEET #3

b. Attach current balance sheets and profit and loss statements (less than sixty days old). Also attach the business' federal income tax statements for the past five years and the previous year's cash-flow statement.

(NOTE: You need not attach these to this assignment sheet unless you are actually meeting with a loan officer and have real documents to consider.)

c. Attach a copy of the sales agreement that transfers the business to you, including a breakdown of inventory, facilities, and equipment; outstanding debts; transferrable licenses and permits; and other expenses or assets. Include also a listing of any permits already acquired, with descriptions and effective dates.

d. Describe the existing business plan and tell how you intend to change it (if at all). You should include information about the facilities and location, hours, staffing, sales techniques, methods of purchasing, and other facts that will show that you are knowledgeable about business practices and that you are working to make a profit.

e. List any life or casualty insurance coverage you have that will be connected with the business.

ASSIGNMENT SHEET #3

D. Projections

1. Explain how much money you expect to make or lose each month for the first year of operation and give reasons for your expectations.

Month one — ____________________

____

Month two — ____________________

____

Month three — ____________________

____

Month four — ____________________

____

Month five — ____________________

____

Month six — ____________________

____

Month seven — ____________________

____

Month eight — ____________________

____

Month nine — ____________________

____

Month ten — ____________________

____

Month eleven — ____________________

____

ASSIGNMENT SHEET #3

Month twelve — ____

____

(NOTE: Many lenders would also ask you to project your cash flow each month during the first year. You may wish to discuss cash flow with the lending officer with whom you are working.)

2. Explain what you think you can expect to have in the way of assets and debts one year after the loan. Give reasons for your expectations.

(NOTE: Assets are those things that the company has paid for and owns completely, such as facilities, inventory, and equipment.)

____

____

____

____

____

____

____

____

____

____

____

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____

____

ASSIGNMENT SHEET #3

SAMPLE LOAN PACKAGE SUMMARY

Cedar Ridge Development Company, Inc.
114 W. Haskell Ave.
Cedar Ridge, Oklahoma 74989

Nature of business:	Cedar Ridge Development Company, Inc. (CRDC) has been formed to develop a 38-acre tract of land southwest of the town of Cedar Ridge. The plat consists of fifteen building sites ranging in size from 2.4 to 3.1 acres. Approximately 4.8 acres are reserved for streets and easements. CRDC plans to grade and pave roads, partially clear lots, and landscape the entrance to the development and other areas retained by the company.
Amount and purpose of loan:	CRDC would like to obtain $108,000 to make improvements to the property. Approximately $40,000 would be required in each of the first two months, with $20,000 and $8,000 respectively for the third and fourth months.
Repayment terms:	CRDC offers to repay the loan at a rate of approximately $3,000 per month for a period of not more than eighteen months, with a balloon payment of the balance. Cash flow should allow payments to begin four months from the date of the loan.
Equity share of borrower:	CRDC is incorporated under the laws of the State of Oklahoma. Currently, all shares are owned jointly by Ralph and Wanda Cummings. The sale of each lot will include ten shares of common stock, amounting to 3 percent of the stock available, or a total of 45 percent of the stock. Fifty-five percent of the stock will be retained by Ralph and Wanda Cummings upon selling all lots under development. Monies paid for shares will be placed in an interest-bearing account and used for maintenance of CRDC-owned streets and grounds within the development. A copy of the articles of incorporation is included as attachment 1 of this loan package.
Collateral:	Deed to the property being developed is to be placed as collateral for the loan. Appraised value of the undeveloped property as of 15 February 1985, is $76,000.

ASSIGNMENT SHEET #3

SAMPLE LOAN PACKAGE
PERSONAL INFORMATION

Name: Ralph Cummings

Address: 114 W. Haskell Avenue
Cedar Ridge, Oklahoma 74989

Phone: (405) 555-3879

Personal: Born—February 6, 1960
Married, 2 children

Education: Small Business Management Short Course, July 1983
Tulsa Junior College
Tulsa, Oklahoma

The Associated General Contractors of America Apprenticeship Program, September 1980
Tulsa, Oklahoma

River City High School, May 1978
River City, Oklahoma

Carpentry Certificate, May 1978
Riverview Area Vocational and Technical School
River City, Oklahoma

Employment: Framing and trim carpenter
Verdigris Construction Company, June 1983 to present
831 S. Pine Avenue
Bonner, Oklahoma 73989
Jim Ferguson, supervisor

Framing carpenter and roofer
Shaw and Sons Construction Company, October 1980 to June 1983
3319 W. Castle Boulevard
Tulsa, Oklahoma 73988
William Hudson, supervisor

Carpenter's apprentice, laborer
R and R Incorporated, July 1978 to October 1980
4618 Belle Vista Street
Tulsa, Oklahoma 73986
Richard Elmo, supervisor

ASSIGNMENT SHEET #3

SAMPLE LOAN PACKAGE
PERSONAL INFORMATION

Name:	Wanda Kates Cummings
Address:	114 W. Haskell Avenue Cedar Ridge, Oklahoma 74989
Phone:	(405) 555-3879
Personal:	Born—March 31, 1960 Married, 2 children
Education:	Real Estate Short Course, March 1984 Sooner State Area Vocational and Technical School Cedar Ridge, Oklahoma
	B.A., Elementary Education, May 1982 Oklahoma State University Stillwater, Oklahoma
	River City High School, May 1978 River City, Oklahoma
Employment:	Teacher Cedar Ridge Elementary School, August 1984 to present Cedar Ridge, Oklahoma
	Sales agent Cedar Ridge Realty Company (part-time), August 1984 to present Cedar Ridge, Oklahoma Ann McMurtry, Owner
	Teacher Garriot Elementary School, August 1982 to May 1984 Tulsa, Oklahoma Sarah Myers, Principal
Credit references for Ralph and Wanda Cummings:	River City State Bank 102 Main Street River City, Oklahoma 73993
	Oklahoma Teachers' Credit Union 3618 N. Dillingham Avenue Oklahoma City, Oklahoma 73995
	Cedar Ridge Builders' Supply 319 E. Sandusky Street Cedar Ridge, Oklahoma 74989
	First National Bank of Cedar Ridge 203 N. Main Street Cedar Ridge, Oklahoma 74989

ASSIGNMENT SHEET #3

SAMPLE LOAN PACKAGE
FINANCIAL STATEMENT

Personal financial statement of Ralph and Wanda Cummings, including assets of Cedar Ridge Development Company, Inc., as of March 1, 1985.

ASSETS	
Cash on hand and in checking accounts	$1231.18
Savings accounts	$946.70
Life insurance cash value	$1426.00
Real estate: Home	$71,500.00
Land	$76,000.00
Vehicles: Car	$8950.00
Pickup	$8375.00
Tools	$4200.00
Personal property	$10,000.00
TOTAL ASSETS	$182,628.88

LIABILITIES	
Mortgage balance on house	$49,734.00
Notes payable to banks, credit unions, etc.: Car	$6621.25
Pickup	$2744.00
Revolving accounts	$6014.00
Unpaid taxes (inheritance taxes)	$3681.15
Accounts payable (Cedar Ridge Builders' Supply)	$497.36
TOTAL LIABILITIES	$69,291.76
NET WORTH	$113,337.12

ASSIGNMENT SHEET #3

SAMPLE LOAN PACKAGE
BUSINESS PLAN

CEDAR RIDGE DEVELOPMENT COMPANY, INC.
114 W. Haskell Avenue
Cedar Ridge, Oklahoma 74989

History of business: Cedar Ridge Development Company, Inc. was formed and incorporated under the laws of the State of Oklahoma on January 25, 1985, with offices at 114 W. Haskell Avenue, Cedar Ridge, Oklahoma. The company's primary asset is a tract of land transferred to the company by the major shareholders, Ralph and Wanda Cummings and obtained by them through inheritance.

Plan of operation: Upon securing adequate financing, CRDC will develop the tract into fifteen home sites according to the attached plat plan. The lots will be sold through the company's real estate division, headed by licensed agent Wanda Cummings. Selling prices will range from $12,500 to $15,000. Lots will be sold to individuals and to construction companies interested in building houses in the $85,000 to $110,000 price range meeting the restrictions outlined by the company. A minimum of five of the houses will be built under contract with individuals by the CRDC construction division under the supervision of Ralph Cummings. Additionally, profits from contracted construction may be applied toward the construction of two to three houses built on speculation.

Total cost for developing the land will be approximately $200,000, excluding the costs of building houses. Development should be complete within three years.

Owners of the homes will become stockholders in CRDC, which shall create a trust fund to cover the costs of maintaining the development. Terms of the agreement and trust are contained in the bylaws of the corporation.

Sales plan: The development will be advertised locally in newspapers, on radio, and by billboard. Special events will include a grand opening and open houses.

The company belongs to the Cedar Ridge Chamber of Commerce and adheres to its objectives and procedures. Ralph and Wanda Cummings are active in the community. They are well known and trusted.

The real estate division is affiliated with the Cedar County Real Estate Council and subscribes to its multilisting service.

The construction division is affiliated with the Green Country Home Builders' Association. Other GCHBA members have pledged support with building materials and construction crews and are enthusiastic about the project.

ASSIGNMENT SHEET #3

Managerial capacity:

Both Ralph and Wanda Cummings have demonstrated sound business skills and practices. Mrs. Cummings graduated at the top of her class in real estate school and has twice been monthly sales leader for brokers with whom she has worked, despite the fact that much of her work in the real estate field has been part-time while she has served as a school teacher.

Ralph was recently promoted to crew supervisor at the company where he presently works. Additionally he has done independent contracting work for the past five years, doing remodeling work with a crew of two. All of his employers and those contracting his services have been well-pleased with his work. Letters of reference are attached.

The Cummings have demonstrated their seriousness in this project through careful research into the need and marketing strategies for the development. They have followed the laws and regulations regarding corporations in this state and have worked closely with local chambers of commerce, the Small Business Administration, and professional organizations to ensure that a market exists and that the community has access to the resources necessary to make the project a success.

Market potential:

Studies by the Cedar Ridge Chamber of Commerce and the Green Country Development Board show a pressing need for such a development. The Chamber estimates that between forty and fifty homes in this price range will be needed over the next three to five years. The new ball-bearing plant and continued petroleum activity will continue to draw people to this area. The Chamber's report emphasizes that the town of Cedar Ridge will not be able to provide adequate water and sewage treatment without the aid of private developers.

The Cedar County Real Estate Council reports a critical shortage of rural acreages, "especially for homes about $100,000 on wooded sites of less than five acres." Time on the market for such houses is averaging less than two months and is not expected to exceed four months during the next two years. The return of lower interest rates has further stimulated this market.

Development of Cedar Ridge Estates will stimulate the community's economy. Approximately $1.5 million will be spent on building materials for the project. At least half of the houses will be financed locally if current trends hold true. Development of the project will create fifteen to twenty jobs in construction alone. The development will create a sizeable boost in property tax revenues, resulting in better facilities and services for the community.

ASSIGNMENT SHEET #3

SAMPLE LOAN PACKAGE
PROJECTIONS

Profit and loss:

Reasonable projections show that two lots will be sold and one house started by CRDC during the first month of business. In the next two months, one more lot will be sold each month, with the rate probably dropping to one every other month thereafter. Meanwhile, construction will be completed on a new home every four months. Thus, income will start at about $53,000 per month, but will drop to $25,000 to $39,000 per month. Income will be approximately $14,000 in those months after construction is complete until all home sites are sold.

However, the majority of devolopment costs will be early in the project. By completing all tract development in the first year, total expenses should be approximately $476,000, including payment on the loan. Income will produce $412,000 (on assumption that three houses will be built by the construction division). This would lead to a loss of $64,000 in the first year.

During the second year, costs will be greatly reduced, totaling about $145,000. During the same period, income should reach approximately $256,000. Thus, profits in the second year would be at least $111,000.

In the third and final year of development, at least $28,000 will be made from the sale of land. Another $40,000 to $60,000 is possible if the construction division continues to build homes in the development.

Cash flow:

During the first year, monthly expenditures will be approximately $63,000 for the first two months, dropping to $43,000 in the following two months and then to $33,000 for the remainder of the year when development will be completed. In the second year, expenses will run about $20,000 to $23,000 per month, except for the month in which the loan balloon payment is made. Expenses after that will be only those associated with construction costs.

Income averages $25,000 to $39,000 per month as long as the construction division is building homes.

Projections one year from the date of loan:

Assets—Land and improvements	$298,000.00
Liabilities—Balance of loan	$85,000.00
Net worth	$213,000.00

STARTING A BUSINESS
UNIT III

ASSIGNMENT SHEET #4 — EXPLORE PROBLEMS FACED BY ENTREPRENEURS IN OPERATING A BUSINESS

NAME ______________________________ SCORE ______________

Starting and operating a business is a complicated undertaking that can lead to rewarding success or disappointing failure. Usually the failures are a result of poor planning or inadequate preparation. Often it is difficult to prepare for some of the situations that you may face because businesses are subject to the rise and fall of the economy, good and bad weather, support or lack of support from other businesses, fair and unfair treatment by individuals, and many other factors.

In this assignment sheet you will be presented with several case studies of businesses in trouble. The problems generally result from one of the factors discussed in Section II of the Information Sheet that contribute to the success or failure of a business. Part I of this assignment sheet discusses those factors further. Read the material in Part I and then go to the case studies in Part II. For each problem, identify the factor or factors that led to the problem. Then suggest a way the problem might have been avoided, such as by suggesting an agency that could have helped the entrepreneur prepare for the problem.

PART I

A. Management factors

1. Personal qualifications

(NOTE: It is doubtful that a person would possess all of the personal qualifications desirable for good management. However, a person may build on strong areas and try to improve the weak ones. Weak areas can be improved by attending conferences and courses, reading literature in these areas, and observing those with strong qualifications.)

a. Willingness to work long hours

b. Desire to learn

c. Ability to bounce back after a setback

d. Willingness to take risks

e. Ability to get along with others

f. Ability to communicate

g. Ability to sell

h. Ability to lead

ASSIGNMENT SHEET #4

i. Ability to make decisions

j. Ability to organize

2. Professional qualifications

a. Management knowledge

b. Technical knowledge

c. Ability to develop plans and objectives

1) Financial planning

(NOTE: A good financial plan should provide profit objectives as well as sales objectives for various major expenses.)

2) Organizational planning

(NOTE: An effective organizational plan allows for maximum productivity with little or no duplication of effort.)

3) Projects and activities planning

(NOTE: Every small business must take time to plan for the future, prepare necessary schedules and procedures, and make decisions about new activities that should be started.)

B. People factors

1. Recruiting, interviewing, and selecting personnel

a. Recruiting sources

EXAMPLES: State employment services, private placement services, educational facilities, general public

b. Interviewing skills

(NOTE: These skills determine how well a business can select the best employees from those available in the labor market.)

2. Personnel practices

(NOTE: These practices determine to a large part how people will be motivated to devote their full capabilities for the benefit of a business.)

a. Pay and fringe benefits

EXAMPLES: Holidays, life insurance, sick leave, vacation, health insurance, retirement

ASSIGNMENT SHEET #4

- b. Working conditions
- c. Grievance procedures
- d. Positive discipline
- e. Administrative procedures

  EXAMPLES: Keeping payrolls prompt and accurate; keeping employees informed about fringe benefits; assisting employees in filing of health insurance claims and worker's compensation claims; scheduling vacations; organizing work

- f. Training

C. Money factors

1. Capital and sources

   (NOTE: Rarely does an owner or group of owners have enough money to conduct all the affairs of a business. For this reason, people must borrow money. Sources of money beyond personal savings include banks, savings and loans companies, the Small Business Administration, and private investors.)

2. Financial management

   - a. Analysis of financial statements

     EXAMPLES: Income statement, expense statement, balance sheet

   - b. Tax management

3. Pricing and credit

   (NOTE: Pricing has a great influence on the volume of business and on the profitability of that volume; credit when closely controlled can be used to increase sales, open markets to new buyers, facilitate selling, and satisfy customers.)

4. Budgets, cost controls, and records

   (NOTE: These items must include labor cost by operation, material cost, waste, damage, scrap, and markdowns if the business is to record profit or loss accurately.)

D. Market factors

1. Market and market objectives

   - a. Analysis of the product or service
   - b. Definition of the market
   - c. Sources of supply
   - d. Competition

ASSIGNMENT SHEET #4

e. Location

f. Layout

2. Marketing plan

a. Direct sales effort

(NOTE: In a business where customers come to buy the product, it is important to train salespeople properly so that they know the product and how to approach customers. In a business where sales are achieved by contacting customers outside the business, it becomes important to decide whom to see, in what order, and how much effort to spend on each customer.)

b. Advertising and promotion

(NOTE: Advertising and promotion can be very useful in attracting customers to the goods or services offered by a business. However, it may be expensive and should be carefully organized so that it will reach the public with the right message at the right time. Advertising must also occur frequently enough so that the desired results will be achieved.)

PART II — Case Studies

A. Joe Bryan has decided to build homes on speculation. He has purchased a lot and begun construction of a house. One evening after Joe's crew has gone home, a group of children begin playing on the construction site. A ten-year-old boy falls through a cutout in the roof decking that was made for a skylight. The little boy breaks his back, and his parents sue Joe for $350,000 for medical damages, pain and suffering, and mental anguish. Despite the fact that the children were trespassing, the court will probably rule against Joe.

Factor ____________________

Help ____________________

____

B. Alice Muggendorf has always wanted to live in the mountains. She decides one day to relocate her construction company to Colorado to take advantage of a building boom for condominiums near the ski areas. She chooses the town of Glacierview because it is within 50 miles of several ski areas and she figures that most skiers would be willing to drive for an hour to ski. Also, a check of the Glacierview phone directory shows that there are no condominiums in the area. However, on arriving in Glacierview, Alice discovers that the steep winding roads make it at least a three-hour drive to any ski areas and that several of the passes are closed for most of the winter.

Factor ____________________

Help ____________________

____

ASSIGNMENT SHEET #4

C. Chet Clinton runs a cabinet shop. He has found that by hiring unskilled workers at minimum wages he is able to keep his labor expenses at a low level and make more profit on his cabinets. Soon, however, Chet notices that his business has dropped substantially and that his profits are quickly vanishing. When he studies his records, he sees that he has made sales to almost every builder in town, but that very few of them ever buy from him more than once or twice. When he examines the production records, he sees that none of his workers has been with him for more than a year. This does not bother him at first, but then he notices that during a worker's first five to six months, the worker produces at a rate of only 60 to 80 percent of that same worker's production at the end of a year.

Factor ____

Help ____

____

D. Bill Davis builds custom houses. He has made it a policy never to start a new job until the previous house is completed. He feels that he can manage one job, but believes that working on two jobs at one time would be confusing and difficult to coordinate, especially because he has to spend so much time on the job site supervising the crew. Last month, Bill had two families wanting him to build for them, but he asked them to wait until the house that he was working on was finished. Now that that job is complete, he is ready to start a new house. However, both families found other builders and now construction has slowed due to rising interest rates. If Bill does not contract for a new house soon, he will have to lay off his crew.

Factor ____

Help ____

____

E. Melissa Carlisle runs a successful construction company, using two fulltime crews working with supervisors. Howard Randal is the supervisor of one of the crews, and Melissa is aware that he has a drinking problem. Despite the fact that customers have complained, crew members have quit, and a couple of fairly serious injuries have happened because of Howard's on-the-job drinking, Melissa is reluctant to take any action against Howard because he is a dedicated worker and has been with the company for almost twenty years, having started with Melissa's father.

Factor ____

Help ____

____

ASSIGNMENT SHEET #4

F. Tony Lucerno has found that no matter how much business his company does, it seems that they always need more money. Tony believes that it is important to use the latest and newest equipment and to pay best wages to get and keep good employees. His jobs are done with the best materials to keep his customers satisfied. He prides himself on finishing jobs on time, even if it means overtime for his workers. He believes that the real key to success is in doing a lot of business, so he is careful to keep his contract bids low so that his company will have plenty of work to do.

Factor ____

Help ____

____

STARTING A BUSINESS
UNIT III

ASSIGNMENT SHEET #5 — EVALUATE OWN POTENTIAL TO START A BUSINESS

NAME ____ SCORE ________________

One of the most important things that prospective small-business owners can do to ensure business success is to have a good understanding of themselves. It is only through a close self-evaluation that individuals can identify their strengths and weaknesses and determine whether or not they are ready to go into business.

The questionnaire provided in this assignment should make you think about yourself, and about what you need to know to go into your own business. Depending on the type of business, one question may have more weight than another. A certain number of "Yes" or "No" answers, therefore, will not definitely indicate that you are ready to begin your own business. You should realize, however, that if any of these questions cause you to prepare yourself more thoroughly, you are less likely to have problems as you start your business.

PART I

Read each statement in the following questionnaire. Write an "X" in the appropriate blanks.

PERSONAL CONSIDERATIONS

Yes	No	
_____	_____	Common sense is one of my strong points.
_____	_____	I like to make my own decisions and try my own ideas.
_____	_____	I enjoy being challenged and thrive on competition.
_____	_____	I have willpower and self-discipline. I get things done on time and plan ahead.
_____	_____	I like to work, and understand that my own business will require me to work harder and longer—twelve to sixteen hours a day, probably six days a week, maybe even on holidays.
_____	_____	I have the energy to do all the work involved—lifting, hauling, working in a shop, standing, walking, talking, smiling, driving—that the day-to-day operation of this business will call for.
_____	_____	I realize that I cannot be all things to all people at all times but that this will be expected of me in my own business. I can withstand the strain such a situation will create for me.
_____	_____	I do not know everything. There are still things to learn, new ideas for me to consider. I can take advice from others.
_____	_____	I am adaptable. I am not so routine-bound or rigid that I cannot change if the business requires change.

ASSIGNMENT SHEET #5

FINANCIAL CONSIDERATIONS

Yes	No	
_____	_____	I have a head for figures and have looked into my own—and the proposed business'—financial picture thoroughly, preparing all the necessary statements and projections with the help of my accountant, who will inform me of my financial progress.
_____	_____	I have enough money to go into business and can get more from other sources—friends, family, life insurance company. My banker stands ready to give me counseling and advice.
_____	_____	I know that my standard of living will be lowered for several months—even a year or two—until the business begins to show a profit.
_____	_____	I know that I must repay my loan out of after-tax profits before I can see a return on my investment.
_____	_____	I know that it is possible for me to lose my savings—as well as the money I borrow from others—and that even if the business fails, I must pay back all that I owe.
_____	_____	I have always protected myself, my family, and my possessions with insurance and will continue to do so. My insurance agent will help me select the best protection for the business.

MARKETING CONSIDERATIONS

Yes	No	
_____	_____	I know that my community wants, needs, and can support this business and that there are enough people with sufficient inclination to spend money for the goods or services I plan to supply.
_____	_____	I have studied the strengths and weaknesses of my competition, and I know the marketable differences in my product or service.
_____	_____	I know how to go about finding the right location for my business and will select the site only after thorough research.
_____	_____	I have given a good deal of thought to how and where I can best advertise and promote my merchandise or services.

ASSIGNMENT SHEET #5

MANAGEMENT CONSIDERATIONS

Yes	No	
_____	_____	I realize that about 90 percent of business failures are caused by inexperience and poor management. I have several years' experience in this or a related business.
_____	_____	I know the methods a good manager can follow to improve a business and also the mistakes that can drive business away.
_____	_____	I am familiar with and know how to keep inventory records, record and report sales, withhold taxes for the government, and make out official employee and business records and forms.
_____	_____	I know that the employees are the vital link between the business and its smooth operation. My experience or education has prepared me for maintaining positive relationships with employees while obtaining results.
_____	_____	I know how to develop an assistant or "backup" person to run the business when I am not there.
_____	_____	I know what the trade association expects of me and what to expect of it.
_____	_____	I can make my place of business effective and attractive—and stay within the budget.
_____	_____	I know the suppliers and the assistance they can provide.
_____	_____	I know how to forecast sales and expenses and how to use this information to help my business become successful.
_____	_____	I know how to price my goods or services competitively, meet expenses, make the payroll, and still turn a profit.
_____	_____	I know how to control my inventory or production to coincide with peak and slack periods in the business.
_____	_____	I know how to collect past-due accounts without losing customers.
_____	_____	I know how to analyze financial operating statements and can use these as a tool for effective business management.

FINAL CONSIDERATIONS

Yes	No	
_____	_____	I am aware of the advantages of working for someone else rather than going into business for myself and have considered all the alternatives to entering business on my own.

ASSIGNMENT SHEET #5

Yes No

_____ _____ I have investigated the possibility of a franchise operation and know the advantages there might be to a franchising agreement.

_____ _____ I know the advantages—and disadvantages—inherent in a sole proprietorship, partnership, and corporation and know which form of business organization I will select. My attorney will help.

_____ _____ I am aware that I may fail. There is less than a 50-50 chance that I will still be in business two years from now, but it is worth it to me to try.

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ASSIGNMENT SHEET #5

PART II

Evaluate your ability to start a small business by analyzing your responses to the questionnaire in Part I.

A. What are your strengths and weaknesses in each of the major considerations for starting a small business?

STRENGTHS	WEAKNESSES
Financial	
Personal	
Marketing	
Management	

ASSIGNMENT SHEET #5

B. What steps should you take to improve your ability to own a small business?

C. Are there certain considerations over which you have no control? Explain your answer.

D. Are you ready to start a small business? Explain your answer.

STARTING A BUSINESS
UNIT III

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheets #1 through #3 — Evaluated to the satisfaction of the instructor

Assignment Sheet #4

Part I — Evaluated to the satisfaction of the instructor

Part II

A. **Factor** — Management; Joe has demonstrated his willingness to take a risk. His ability to bounce back from a setback will be tested through this situation.

   Help — Liability insurance would help in this situation. It is hoped that Joe has properly managed his business and invested in liability insurance.

B. **Factor** — Marketing; though Alice should have exercised better judgment as a manager by investigating the business move more thoroughly, her real problem results from a lack of a market for condominiums in the area. Alice assumed that such a market existed and ran into trouble when she relocated only to find that her condominium business will probably not be able to succeed in Glacierview.

   Help — A number of agencies and private businesses provide marketing studies to entrepreneurs. The SBA, chambers of commerce, local and state development agencies, and other organizations could have provided Alice with an accurate assessment of her chances of success.

C. **Factor** — Management; Chet has neglected his employees, putting immediate gains over the need to provide employees with adequate benefits. As a result, he has experienced frequent turnover among his employees, and the quality of his product has suffered.

   Help — The SBA could provide Chet with management improvement courses or direct him to schools or organizations that provide such training.

D. **Factor** — Management and money; Bill's policy cripples his business. If he is to succeed, he needs to acquire the skills necessary to manage more than one job at a time. Now he faces money problems as a result of the policy.

   Help — The SBA and schools offering business management courses can help Bill improve his confidence and his management skills. He will probably have to borrow money or restructure his company to overcome the money problems. The SBA and lending institutions may be able to help him resolve his money problems.

E. **Factor** — Management and people; Melissa's failure to take positive discipline with Howard is hampering her company's operation. She needs to remove Howard from such an influential position for the sake of the company. As an employee, Howard represents a people factor because he is not contributing to the company's success.

   Help — Melissa may turn to management advisors for help. She may want to try to solve this particular problem by seeking professional help for Howard.

ANSWERS TO ASSIGNMENT SHEETS

F. **Factor** — Management, money, and marketing; Tony's business philosophy is interfering with the company's success. He operates with high expenses while keeping profits low, and his profits are often consumed by unexpected equipment, labor, and materials costs. He is experiencing money problems because of the low margin of profit. He is probably experiencing a marketing problem also, despite his concern for customer satisfaction and quality work, because his competitors quite likely underbid him on many jobs because of their lower expenses. Many buyers base their decisions on price and may not be aware of the extras offered by Tony.

Help — Tony needs the help of management consultants from the SBA or training institutes. He may need a marketing study done to see how much people are willing to pay for the extras he offers. He will probably need help from an advertising firm or advertising media consultants to publicize the extras offered by his company. The solution to his money problems lies in a workable compromise between what his business philosophy requires and what the marketplace is willing to pay for.

Assignment Sheet #5 — Evaluated to the satisfaction of the instructor

FC - 151-A

STARTING A BUSINESS
UNIT III

TEST

NAME ________________________________ SCORE ______________

1. Match to their correct definitions terms associated with starting a business. Write the correct numbers in the blanks.

______a. Money, buildings, machines, and investments that are used or available to make products or to provide services

______b. Personal or business possessions that a borrower assigns to a lender as a pledge of debt payment

______c. French word meaning "enterpriser"; a person who owns a business

______d. Contract to use an item without purchasing it

______e. Business that is independently owned and not dominant in its field of operation

______f. Federal governmental agency established to assist small business owners

1. Entrepreneur
2. Capital
3. Small business
4. Lease
5. Small Business Administration (SBA)
6. Collateral

2. List primary factors that contribute to the success or failure of a business.

a. ____

b. ____

c. ____

d. ____

3. List five sources of information and assistance available to small-business owners.

a. ____

b. ____

c. ____

d. ____

e. ____

TEST

4. Select from the following list specific advisors available from the Small Business Administration. Write an "X" in the blank before each correct answer.

_____a. Construction crews

_____b. Management consultants

_____c. Loan administrators

_____d. Accountants

_____e. Contract locators

_____f. Advertising agents

5. Describe sources of capital used by entrepreneurs.

____

____

____

____

____

____

(NOTE: Test questions 6 through 10 list the assignment sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

6. Examine expenses involved in starting a business.

7. Write a plan for small-business ownership.

8. Prepare documentation required for a loan application.

9. Explore problems faced by entrepreneurs in operating a business.

10. Evaluate own potential to start a business.

STARTING A BUSINESS
UNIT III

ANSWERS TO TEST

1. a. 2
   b. 6
   c. 1
   d. 4
   e. 3
   f. 5

2. a. Management
   b. People
   c. Money
   d. Market

3. Answer should include any five of the following

   a. Federal government agencies
   b. Chambers of commerce
   c. Community business development councils
   d. Business and trade associations
   e. Credit bureaus
   f. Better business bureaus
   g. Associations of business people
   h. Special libraries and information centers
   i. Business professionals
   j. Personal contacts

4. b, c, e

5. Description should include the following

   a. Owned capital — Money belonging to the entrepreneur
   b. Retained earnings — Company profits used to expand the company
   c. Borrowed capital — Money obtained from lenders such as individual investors banks, finance companies, and the SBA

6. Evaluated to the satisfaction of the instructor

7. Evaluated to the satisfaction of the instructor

8. Evaluated to the satisfaction of the instructor

9. Evaluated to the satisfaction of the instructor

10. Evaluated to the satisfaction of the instructor

INDUSTRY ORIENTATION
UNIT IV

UNIT OBJECTIVE

After completing this unit, the student should be able to discuss carpentry-related job opportunities and be able to apply for a job. The student will show this ability by completing assignment sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. List levels of training for carpentry-related jobs.
2. List job opportunities open to skilled carpenters.
3. Select from a list personal attributes or attitudes that an employer looks for in an employee.
4. List documents that an applicant may need to prepare when applying for a job.
5. Write a résumé.
6. Write a letter of application.
7. Complete an employment application.
8. Make an interview appointment by telephone for a carpentry job.
9. Write a follow-up letter or make a follow-up telephone call after interviewing for a carpentry job.
10. Complete a W-4 form.

INDUSTRY ORIENTATION
UNIT IV

SUGGESTED ACTIVITIES

I. Unit contents

  A. Objective sheet

  B. Suggested activities

  C. Assignment sheets

    1. Assignment Sheet #1 — Complete a Personal Information Sheet

    2. Assignment Sheet #2 — Write a Résumé

    3. Assignment Sheet #3 — Write a Letter of Application

    4. Assignment Sheet #4 — Complete an Employment Application

    5. Assignment Sheet #5 — Make an Interview Appointment by Telephone for a Carpentry Job

    6. Assignment Sheet #6 — Practice Interview Questions

    7. Assignment Sheet #7 — Write a Follow-Up Letter or Make a Follow-Up Telephone Call After Interviewing for a Carpentry Job

    8. Assignment Sheet #8 — Compare Job Opportunities

    9. Assignment Sheet #9 — Complete a W-4 Form

  D. Answers to assignment sheets

  E. Test

  F. Answers to test

II. Instructor's guide

  A. Obtain materials needed to supplement unit.

    1. Films

(NOTE: The following films are available on a free-loan basis to Oklahoma teachers. Oklahoma teachers may order the films from the Oklahoma State Department of Vocational and Technical Education, Curriculum and Instructional Materials Center, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074. Out-of-state teachers must order from the addresses accompanying the films.)

SUGGESTED ACTIVITIES

a. *Getting a Job Is a Job*. Color, 20 minutes, Dibie-Dash Productions, Inc., 1966. Available from Dibie-Dash Productions, Inc., 4949 Hollywood Boulevard, Suite 208, Hollywood, California 90027.

(NOTE: This film discusses self-analysis, data sheets, and job sources.)

b. *Your Job: Applying for It*. Color, 13 minutes 30 seconds, Coronet Films, 1968. Available from Coronet Films, 65 East South Water Street, Chicago, Illinois 60601.

(NOTE: This film discusses appearance, leads, and perseverance.)

c. *Your Job: Finding the Right One*. Color, 13 minutes 30 seconds, Coronet Films, 1968. Available from Coronet Films, 65 East South Water Street, Chicago, Illinois 60601.

(NOTE: This film discusses a plan of action for job hunting.)

d. *Job Interview: I Guess I Got the Job*. Color, 13 minutes, McGraw-Hill. Available from McGraw-Hill Films, 110 Fifteenth Street, Del Mar, California 92014.

(NOTE: Through flashbacks, this film views approaches of two applicants for a job.)

e. *Get the Job: Line Up Your Interview*. Color, 11 minutes, Coronet Films, 1976. Available from Coronet Films, 65 East South Water Street, Chicago, Illinois 60601.

(NOTE: This film reviews how to write a résumé, choose a job objective, write a letter, and get a job.)

f. *Interview: Ready or Not*. Color, 24 minutes, Churchill Films, 1975. Available from Churchill Films, 622 North Robertson Boulevard, Los Angeles, California 90069.

(NOTE: This film explores the importance of a good self-concept during a job interview.)

2. Films and teaching kit—*Critical Steps of Job Interviewing*

(NOTE: This kit consists of a 16 mm film, five cassettes, and programmed learning notebooks. It is available for purchase from Oklahoma State Department of Vocational and Technical Education, Curriculum and Instructional Materials Center, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074.)

SUGGESTED ACTIVITIES

3. Pamphlets

    a. *How to Get and Hold the Right Job*

    b. *How to Prepare Yourself for Job Interviews*

    c. *How to "Sell Yourself" to an Employer*

    (NOTE: All the above pamphlets are available from the nearest state employment service office.)

    d. *Appointment with Tomorrow.* Available from Vaseco, Inc., 2301 Classen Boulevard, P.O. Box 60274, Oklahoma City, Oklahoma 73106.

    e. *How Not to Blow a Job Interview.* Pamphlet available free from Army Reserve recruiter. U.S. Government Printing Office, 1978.

    f. *Making the Most of Your Job Interview.* Pamphlet available free from New York Life Insurance Company, 51 Madison Avenue, New York, New York 10010.

B. Introduce the unit by discussing the variety of jobs available in the construction industry, emphasizing those that require skills taught in this course.

SUGGESTIONS:

- Make a bulletin board display with ads and job notices for carpentry-related openings; also include Department of Labor or other agency forecasts for employment needs within the industry for the next few years.
- Make available books that describe various jobs in the carpentry trade.
- Obtain current statistics for your area or state on expenditures for construction, building permits, and so forth.

C. Provide students with objective sheet.

D. Discuss unit and specific objectives, emphasizing how each objective relates to the course goal of qualifying the student for employment within the industry.

E. Provide students with information and assignment sheets.

F. Discuss information and assignment sheets.

1. Use Information Sheet, Section I to acquaint students with the levels of training available in the trade.

    SUGGESTIONS:

    - Relate the levels of training to specific carpentry-related occupations.

SUGGESTED ACTIVITIES

- Provide students with brochures and pamphlets from various types of carpentry training programs, such as those from colleges offering construction management programs.
- Invite representatives from agencies involved in carpentry training to discuss their programs with the class. You may wish to take the class to some of the agencies so that students may view the training in progress.

2. Use Information Sheet, Section II to discuss job opportunities available in the carpentry trade.

SUGGESTIONS:

- Emphasize those specialties that are prevalent in your area and those for which your program is most tailored.
- Discuss the particular skills and tasks required for the specialties in which the students are particularly interested.
- Invite workers from various carpentry jobs to talk to the class about the kind of work they do and what they like and do not like about their jobs.

3. Use Information Sheet, Section III as an outline for discussing traits that an employer looks for in an employee.

SUGGESTIONS:

- Emphasize that the traits listed in Section III are helpful to any worker, not just to those in carpentry-related fields; relate the traits to specific actions and attitudes for carpenters.

EXAMPLES: A good carpenter should have a good set of tools and use and care for those tools properly.

A good worker realizes that there is always more to learn and ways to improve; a good carpenter never tries to hide weaknesses in skills or knowledge.

A good carpenter observes all safety rules, even if some of them seem stupid, because the worker realizes that there are sound reasons for each rule.

A good carpenter is interested in doing a good job and takes pride in his or her work.

- Stress to the students that the traits listed in Section III will aid them during their training in this program and in dealing with life's situations in general.
- Invite appropriate employers to the class to discuss the traits that they look for in potential employees and how they go about determining whether job applicants have those traits.

SUGGESTED ACTIVITIES

4. Review Information Sheet, Section IV, and use it as an introduction to the hiring process; discuss the hiring process and the documents that may be required in obtaining a job.

   SUGGESTIONS:

   - Use Assignment Sheets #2, #3, #4, and #7 to reinforce proper format for résumé, letter of application, application form, and follow-up.
   - Use Assignment Sheets #1 and #9 to allow students to practice completing forms. Emphasize the need for accuracy and neatness, and try to overcome any fears in students who are intimidated by forms.
   - Use Assignment Sheet #5 to allow students to practice making an interview appointment by telephone. Stress that this call is the first contact an applicant may have with the firm.
   - Take students to a state or private employment agency and allow the agency staff to explain their functions and services.
   - Use the films and other supplements mentioned in this section to expand the Information and Assignment Sheets.
   - Repeat Assignment Sheet #6 or similar interviewing role-plays in a variety of ways to allow the students to gain the most benefits.

     EXAMPLES: Videotape the interviews and allow the students to watch themselves; invite people with hiring responsibilities to act as the interviewer; allow the students to critique each other's interviews; change the questions.

   - Use actual job notices and contact with actual employers to obtain the information necessary for Assignment Sheet #8; emphasize the many different factors besides salary that enter into an employment decision.

     EXAMPLES: Benefits, travel requirements, advancement opportunities, the sense of achievement, the chance to develop new skills

   - Invite recent graduates of your program to talk to the students about what they discovered upon entering the job market, about what surprised them, about how this training prepared them, and about how their attitudes may have changed since the time they first entered training.
   - Review this unit at the end of the course, or when students are ready to enter on-the-job training.

SUGGESTED ACTIVITIES

G. Review information.

H. Give test.

I. Complete appropriate section of competency profiles.

(NOTE: Competency profiles are available from AGC and CIMC.)

III. Unit references

A. Hendrix, Laborn J. "Bud." *Heavy Equipment Operator Instructional Material*, Vol. I. Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and The Associated General Contractors of America, 1981.

B. *Occupational Outlook Handbook*. Bulletin No. 1650. Washington, D.C.: U.S. Department of Labor Statistics, 1970-71.

C. Spann, Margaret. *English II*. Revised by Teresa Eacret, *et al*. Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1983

INDUSTRY ORIENTATION
UNIT IV

INFORMATION SHEET

I. Levels of training for carpentry-related jobs

   A. Preparation

      EXAMPLES: Vocational/technical training, on-the-job, high school

   B. Apprenticeship

      EXAMPLES: Union, open shop

   C. Post-secondary

      EXAMPLES: College or university, technical school, business school

   D. Up-grading

      EXAMPLES: Open shop training programs, special programs of materials and equipment companies, research and testing organizations, technical training schools

II. Job opportunities open to skilled carpenters

   A. Construction

      EXAMPLES: Form builder, framer, roofer, floor layer, Sheetrock hanger, trimmer, finish carpenter, cabinet builder

   B. Construction management

      EXAMPLES: Architect, structural engineer, estimator, safety engineer, supervisor, manager and planner

   C. Training

      EXAMPLES: Apprenticeship (union and open shop) instructor, vocational training center instructor, school shop teacher, equipment and materials instructor for workshops and seminars, writer

   D. Lumber industry

   E. Prefabrication shops

   F. Remodeling, restoration, and maintenance

   G. Cabinet and furniture shops

INFORMATION SHEET

  H. Mobile home construction

  I. Building materials and tool sales and service

III. Personal attributes or attitudes that an employer looks for in an employee

  A. Enthusiasm and interest

  B. Dedication and dependability

  C. Alertness, quickness of mind

  D. Honesty and integrity

  E. Desire to work

  F. Knowledge and pride in the trade

  G. Desire to help others

  H. Desire to improve oneself

IV. Documents that an applicant may need to prepare when applying for a job

  A. Résumé

  (NOTE: A résumé is a brief summary of one's qualifications and work-related experiences.)

  B. Letter of application

  (NOTE: A letter of application states the applicant's interest in the position and shows the emloyer how the applicant will be useful to the business. A letter of application usually includes a copy of the résumé.)

  C. Job application

  (NOTE: A job application is a form on which the applicant provides specific information about his or her personal history, job history, job experience, education, and references.)

  D. Follow-up letter

  (NOTE: A follow-up letter is mailed after the interview to thank the interviewer for the interview and to refresh the interviewer's memory.)

INDUSTRY ORIENTATION
UNIT IV

ASSIGNMENT SHEET #1 — COMPLETE A PERSONAL INFORMATION SHEET

NAME ____________________ SCORE ____________

As you seek a job, you will be asked to complete various forms. You must always try to complete these forms neatly and accurately. Once you are hired, there will be other forms to fill out, usually including a form for personal information that may be necessary should the company need to contact your next of kin. Because of the jobs you will be performing in this program, such information will also be of use to your instructor.

Complete the following personal information sheet and hand in to your instructor.

Name ____________________ Class ____________________

Home Address ____________________

Home Phone ____________________

Parents' (Guardians') Names ____________________

Parents' Occupations ____________________

____

____

____

Parents' Business Phones ____________________

Place Where Parents Can Be Reached in Case of an Emergency ____________

____

Family Doctor ____________________

Shop Courses You Have Taken ____________________

____

Trade Experience ____________________

____

Name of Insurance Company ____________________

____

INDUSTRY ORIENTATION
UNIT IV

ASSIGNMENT SHEET #2 — WRITE A RÉSUMÉ

NAME ______________________________ SCORE ______________

A good résumé should immediately give prospective employers a brief summary of your accomplishments, educational background, work experience, skills, and job objective.

Write a résumé, using accurate facts about yourself. Use the following information and the sample included in this assignment sheet as guides. It is not necessary to use the exact wording and outline form used on the sample, but it is necessary that your résumé be neat and balanced and contain all the information that might help you get a job.

Keep your résumé updated, and use it when you apply for jobs.

Guidelines for Writing a Résumé

A. Inspect several résumé formats and choose one that best fits your needs, or use the example included in this assignment sheet as a guide.

B. Type your résumé on 8½-by-11-inch white paper. Try not to exceed one page, but attempt to fill the page.

C. Spell correctly. Many employers will not consider persons whose résumés include misspelled words.

D. Put your name prominently at the center top or in the upper left-hand corner. Beneath your name, give full street address, city, state, ZIP code, telephone number with area code, and a number where messages can be accepted.

(NOTE: You may want to leave space to fill in your address on a printed résumé if you expect to change addresses.)

E. Do not include birthplace, age, health, height, weight, sex, marital status, photograph, salary, or reasons for leaving previous job. Avoid giving religious and political affiliations.

(NOTE: In general, the more information you are willing to share the better; however, the whole point of the résumé is to interest employers in meeting you. The above information may or may not be asked during the interview. By not including this information, there is little or no chance for discrimination because of race, color, religion, sex, or national origin.)

F. Describe your job objective or career goal briefly. Do not restrict yourself to a specific job.

ASSIGNMENT SHEET #2

G. Describe your educational background, giving dates of enrollment, diplomas or degrees received, and names of schools attended. Include grade average (if favorable) and major course of study. If you include school grades, be sure that they are related to the jobs you have in mind.

(NOTE: Applicants with less than one year of work experience should list education before work experience; with more than one year, put experience first. In résumé writing, accentuate the positive, eliminate the negative. If pertinent, mention additional courses, scholarships, or summer school.)

H. List your past employment, starting with your most recent job. Carefully examine all of your jobs—including extracurricular activities. Concentrate on the skills; do not categorize "summer jobs."

(NOTE: The list should include the name of the company, your job title, and your major duties. The starting and termination dates for each job should also be listed.)

I. List skills useful to the job. Remember, you have to prove your value to the business, especially if you have little experience.

(NOTE: Use active verbs to indicate the specific tasks you performed, e.g. *built, assisted, operated.*)

J. Include the following information if it is relevant and if there is enough space: hobbies and interests, extracurricular activities, clubs, and awards you have received.

K. Ask at least three persons to serve as your references; ask yourself the kinds of recommendations they will give you.

EXAMPLES: Business references (previous employers and co-workers), school references (teachers), character references (minister, rabbi, neighbor who knows you well)

(NOTE: Avoid listing relatives unless you have actually worked for them on a salaried basis. Include addresses, titles, and phone numbers so that the prospective employers can contact your references.)

L. Write "CONFIDENTIAL" at the top of the résumé if you do not want your current employer to know that you are looking for employment.

M. Have a local printer retype your résumé and reproduce several copies. Request white bond paper.

(NOTE: The physical appearance of your résumé is *very* important. Avoid using ditto or carbon copies. Be sure to proofread the printer's work. Always take extra copies to the interview. Leave one copy of your résumé with the interviewer and use one as a reference when filling out the application form. You should also mail one résumé with your letter of application.)

ASSIGNMENT SHEET #2

SAMPLE RÉSUMÉ

RÉSUMÉ

Terry L. McKracken
774 East Adams Street
Anytown, Yourstate 77704
Phone: (800) 555-7779

September 3, 1984

Job Objective: Career in carpentry leading to position of construction manager

EDUCATION

1975-1979	Anytown High School, Anytown, Yourstate 77704 *Activities:* President of senior class *Career-related courses:* Algebra, two semesters; geometry, two semesters; industrial arts woodworking, two semesters
1977-1979	Progress Vo-Tech, Progressville, Yourstate 77802 *Activities:* President of VICA *Honors:* Carpentry contest, 1st place, state; 3rd place, national *Courses:* Vocational carpentry, two years (1,080 hours); basic drafting, two semesters *Certificate:* Carpentry, four semesters *Grade average:* 3.5 on a 4.0 scale

WORK EXPERIENCE

1979—	Jones Construction Company, Progressville, Yourstate 77802 Work as carpenter's helper; responsible for assisting with building layout, framing of exterior and interior walls, erecting trusses, installing sheathing, decking roofs, laying flooring, hanging drywall, installing exterior finish
1977-1978	Vocational Carpentry Class, Progressville, Yourstate 77802 As a student, built or assisted with all phases of construction; learned and observed basic safety and first-aid rules
1977-1978	Youth Fellowship Organization, Anytown, Yourstate 77704 Work as treasurer required planning and organization, written reports, math and accounting skills, and collection responsibilities

REFERENCES

Mr. John Naildriver
Construction Supervisor
Jones Construction Company
Progressville, Yourstate 77802
(800) 555-9578

Mr. Sammy Slavedriver
Vocational Carpentry Instructor
Progress Vo-Tech
Progressville, Yourstate 77802
(800) 555-0289

Ms. Jerry Smith
Youth Director
Parkview Church
711 Fellowship Circle
Anytown, Yourstate 77704
(800) 555-4307

INDUSTRY ORIENTATION
UNIT IV

ASSIGNMENT SHEET #3 — WRITE A LETTER OF APPLICATION

NAME ______________________________________ SCORE ________________

The application letter is a sales technique to tell the employer how your abilities will be useful to the business. While the resumé gives general background information, the letter of application should specify your qualifications. Not all jobs require formal applications and interviews, but there are an increasing number of companies using these hiring techniques.

Cut a help wanted ad for a carpentry job from the classified ad section of the local newspaper. Write an application letter to accompany the resumé you prepared in Assignment Sheet #2. Use as guides the following information and the sample letter at the end of the assignment sheet.

Guidelines for Writing a Letter of Application

(NOTE: If you cannot type, write or print neatly, using blue or black ink.)

A. Use acceptable form and appearance

    1. Type or write neatly

    2. Write on only one side of the paper

    3. Avoid smudges and typographical errors

    4. Use 8 1/2-by-11-inch white bond paper, not personal or fancy paper

    5. Spell, capitalize, and punctuate correctly

    6. Include employer's full name, title, and address

    7. Include your full name and address with ZIP code

    8. Retain a copy for further reference

B. Include proper information

    1. Write to a specific person

    (NOTE: Find out the name and the correct title of the person with hiring responsibility for the job that interests you. When in doubt, write to the top person who will refer your resumé to the right party. Use "To Whom It May Concern'" if answering a blind ad.)

    2. Avoid excessive use of the pronoun "I"

ASSIGNMENT SHEET #3

3. Be brief

   a. Do not repeat all information that is in the résumé

   b. Avoid needless details

   c. Cover all points requested in the advertisement in exactly the order in which they were asked

   (NOTE: Some prospective employers make it a point of testing the applicant's ability to follow directions.)

4. State the position for which you are applying

5. State the reason(s) for your interest in the job

   (NOTE: Employers look for people who want future advancement opportunities rather than just a paycheck.)

6. Refer briefly to the main points in the attached résumé

7. Mention that persons listed on the résumé have given their permission to serve as references

8. Request an interview at the employer's convenience

   a. Tell where you can be reached

   b. Enclose a self-addressed envelope and your résumé

   c. Say that you will telephone next week

C. End the letter properly

(NOTE: "Sincerely" or "Very truly yours" is appropriate.)

D. Use your permanent address for the return address

E. Staple the letter to the résumé: they may be circulated to several departments and could become separated

F. A week later, follow up and telephone for an appointment

(NOTE: Do not be surprised if your résumé has been referred to another department. Remember, the company is in business, and you may not get immediate attention, especially if you sent a letter in response to a blind ad. Be persistent until you reach the right person, and then ask for a convenient date to set up an interview.)

G. Keep in touch regarding possible openings now and in the future

(NOTE: The job hunt may take several weeks or even months. It is important to keep your prospects active without being a nuisance.)

ASSIGNMENT SHEET #3

SAMPLE LETTER OF APPLICATION

774 East Adams Street
Anytown, Yourstate 77704
September 3, 198—

Mr. John Jones
Personnel Director
Jones Construction Company
Box 19
Progressville, Yourstate 77802

Dear Mr. Jones:

Please consider me for the job of rough framing carpenter that you advertised in the *Daily Chronicle*.

The skills I have learned in my high school vocational carpentry courses should qualify me for this job. I have had experience in all of the basic skills required in residential construction, including the safe use of power tools.

I graduated from high school in August, and I would like to become a carpenter. A more complete description of my qualifications is given in the enclosed résumé.

I would appreciate the opportunity to come and talk over this job opportunity at your convenience. I can be reached by telephone at 800-555-7779 after 3:30 or at the above address.

Sincerely yours,

Terry McKracken
Terry McKracken

Enclosure

INDUSTRY ORIENTATION
UNIT IV

ASSIGNMENT SHEET #4 — COMPLETE AN EMPLOYMENT APPLICATION

NAME ________________________________ SCORE ______________

This employment application will give you the opportunity to see what an application looks like and give you a chance to fill one out before you actually apply for a position.

Complete the following application form, using the guidelines below and information about yourself from your résumé.

(NOTE: Although each business uses its own form, general rules of preparation apply to any form.)

Guidelines for Completing an Employment Application

A. Be prepared

   1. Take a good ink pen

   2. Take copies of résumé

B. Look over the entire form before starting to write; do not hurry

C. Follow directions

   1. Note whether information is to be printed or written

   2. Carry out all directions

D. Write clearly, neatly, and legibly

E. Answer briefly

F. Be honest

G. Answer all questions

   (NOTE: If questions do not apply to you, write "Not Applicable" or "N/A" in the space to show that you did not overlook the question.)

H. Include complete information

I. Recheck application when finished

J. Avoid crossing out and erasing

K. Use the word "open" for question about minimum salary because most employers pay standardized rates and will not negotiate on salary

ASSIGNMENT SHEET #4

"WE ARE AN EQUAL OPPORTUNITY EMPLOYMENT COMPANY. WE ARE DEDICATED TO A POLICY OF NON-DISCRIMINATION IN EMPLOYMENT ON ANY BASIS INCLUDING RACE, CREED, COLOR, AGE, SEX, RELIGION OR NATIONAL ORIGIN OR PHYSICAL DEFECTS."

APPLICATION FOR EMPLOYMENT

PERSONAL INFORMATION

DATE ____

NAME ____ LAST ____ FIRST ____ MIDDLE ____

PRESENT ADDRESS ____ STREET ____ CITY ____ STATE ____ ZIP ____

PERMANENT ADDRESS ____ STREET ____ CITY ____ STATE ____ ZIP ____

PHONE NO ____ SOCIAL SECURITY NUMBER ____

REFERRED BY ____

EMPLOYMENT DESIRED

POSITION ____ DATE YOU CAN START ____ SALARY DESIRED ____

ARE YOU EMPLOYED NOW? ____ IF SO, MAY WE INQUIRE OF YOUR PRESENT EMPLOYER ____

EVER APPLIED TO THIS COMPANY BEFORE? ____ WHERE ____ WHEN ____

EDUCATION	NAME AND LOCATION OF SCHOOL	YEARS ATTENDED	DATE GRADUATED	SUBJECTS STUDIED
GRAMMAR SCHOOL				
HIGH SCHOOL				
COLLEGE				
TRADE, BUSINESS, OR CORRESPONDENCE SCHOOL				

SUBJECTS OF SPECIAL STUDY OR RESEARCH WORK ____

U.S. MILITARY OR NAVAL SERVICE ____ RANK ____ PRESENT MEMBERSHIP IN NATIONAL GUARD OR RESERVES ____

ACTIVITIES OTHER THAN RELIGIOUS (CIVIC, ATHLETIC, FRATERNAL, ETC.) ____

Exclude organizations, the name or character of which indicates the race, creed, color, or national origin of its members.

(CONTINUED ON OTHER SIDE)

ASSIGNMENT SHEET #4

FORMER EMPLOYERS (LIST BELOW LAST FOUR EMPLOYERS, STARTING WITH LAST ONE FIRST.)

DATE MONTH & YEAR	NAME AND ADDRESS OF EMPLOYER	SALARY	POSITION	REASON FOR LEAVING
FROM				
TO				
FROM				
TO				
FROM				
TO				
FROM				
TO				

REFERENCES: Give below the names of two persons not related to you, whom you have known at least one year.

NAME	ADDRESS	BUSINESS	YEARS ACQUAINTED
1			
2			

PHYSICAL RECORD:

List any physical defects

WERE YOU EVER INJURED? GIVE DETAILS

HAVE YOU ANY DEFECTS IN HEARING? IN VISION? IN SPEECH?

IN CASE OF EMERGENCY NOTIFY

NAME ADDRESS PHONE NO.

I AUTHORIZE INVESTIGATION OF ALL STATEMENTS CONTAINED IN THIS APPLICATION. I UNDERSTAND THAT MISREPRESENTATION OR OMISSION OF FACTS CALLED FOR IS CAUSE FOR DISMISSAL. FURTHER, I UNDERSTAND AND AGREE THAT MY EMPLOYMENT IS FOR NO DEFINITE PERIOD AND MAY, REGARDLESS OF THE DATE OF PAYMENT OF MY WAGES AND SALARY, BE TERMINATED AT ANY TIME WITHOUT ANY PREVIOUS NOTICE.

DATE SIGNATURE

DO NOT WRITE BELOW THIS LINE

TO BE COMPLETED DAY EMPLOYMENT BEGINS DATE

HEIGHT WEIGHT AGE DATE OF BIRTH

SINGLE MARRIED WIDOWED CITIZEN U.S.A. SEX

THE ABOVE INFORMATION NEEDED FOR PENSION, HOSPITALIZATION, INSURANCE, ETC., AND NOT FOR HIRING PURPOSES

INTERVIEWED BY DATE REMARKS

NEATNESS		CHARACTER	
PERSONALITY		ABILITY	

HIRED FOR DEPT. POSITION WILL REPORT SALARY WAGES

APPROVED 1. 2. 3.

EMPLOYMENT MANAGER DEPT. HEAD GENERAL MANAGER

INDUSTRY ORIENTATION
UNIT IV

ASSIGNMENT SHEET #5 — MAKE AN INTERVIEW APPOINTMENT BY TELEPHONE FOR A CARPENTRY JOB

NAME ______________________ SCORE ____________

Making an appointment by telephone accomplishes two things. First, it shows that you are interested in saving the employer's time. Second, it shows that you are thoughtful enough to ask the best time for you to see the employer.

PART I

Read the following steps and reminders for making an interview appointment by telephone.

Guidelines for Making an Interview Appointment by Telephone

A. Steps in making an appointment

1. Plan what you are going to say before you call
2. State your name and reason for calling

   EXAMPLE: "Hello, this is Terry McKracken. I am calling about your ad for a rough framing carpenter that appeared in last night's paper. May I make an appointment for an interview?"

3. Ask when would be the best time for you to come for the interview, and ask for the name of the interviewer
4. Record the day, time, and place of the interview, and the name of the interviewer
5. Ask if you should pick up an application form or if they would like to send it to you before the interview
6. Thank the receptionist for the help

B. Things to remember

1. Remember that this call is the first contact you may have with the firm; make that first impression a good one
2. Keep the receptionist on your side; the receptionist is there to help you
3. Do not ask over the telephone how much the job pays
4. Be polite and courteous

ASSIGNMENT SHEET #5

PART II

Now that you have read about the correct way to arrange for a job interview, role-play a situation in which you make an interview appointment for a carpentry job by telephone. Use the checklist below to evaluate your performance.

	Yes	**No**
Was prepared before calling	☐	☐
Did not have to stammer to find the right words	☐	☐
Immediately identified self	☐	☐
Immediately stated reasons for calling	☐	☐
Asked the best time for an appointment with employer	☐	☐
Was courteous and friendly	☐	☐
Asked about picking up application form or having application form sent prior to interview	☐	☐
Thanked the receptionist	☐	☐
Made record of the interview date, hour, and place, and of interviewer's name	☐	☐

INDUSTRY ORIENTATION
UNIT IV

ASSIGNMENT SHEET #6 — PRACTICE INTERVIEW QUESTIONS

NAME ________________________________ SCORE ______________

An employer may not legally ask questions about an applicant's personal life. In fact, it is illegal for an employer to ask what your maiden name is if you are a female applicant; what your marital status is; who lives with you; what church you attend or who your spiritual leader is; how many children you have, their ages, or who will care for them while you are at work; whether you rent or own your residence; whether you have ever had your wages garnisheed; or whether you have ever been arrested. However, many interviewers, particularly those in small businesses, sometimes ask such questions anyway. Whether or not you choose to answer such questions depends on how much you want the job.

The following questions are some that might be asked on an application form or during a job interview. Write an answer for each question. Keep this assignment sheet to review before going to an interview.

A. Why did you leave your previous job?

(NOTE: Try to be positive in stating your reasons for leaving a former job. Do not downgrade your previous employer.)

____

B. What did you like best about your job?

____

C. Are you in good health? ______________________

D. Do you intend to make this work your career? ______________________

E. What are some of your special abilities?

____

____

F. What equipment do you operate?

____

____

G. How would you rate your training for this job? Very good? Fair? Why?

____

ASSIGNMENT SHEET #6

H. What personal characteristics do you think are needed to succeed in your vocation?

____

____

I. At what salary do you expect to start?____________________

J. How could you contribute to our organization?

____

____

____

K. Why should we hire you?

____

____

____

L. Tell us about your family and any plans for marriage or further education.

(NOTE: Remember, legally you do not have to answer this question. However, it is a good idea to have an answer.)

____

____

M. Have you applied for any other job?

____

N. Do you have any military obligations to fulfill?

____

O. Would you be able to work Saturdays and Sundays?

____

P. Does negative criticism disturb you?

____

ASSIGNMENT SHEET #6

Q. Would you be willing to relocate?

R. What size city do you prefer? Why?

S. Define *cooperation.*

T. How do you feel about working overtime?

REMEMBER: You never get a second chance to make a good first impression. Getting a job is a job!

INDUSTRY ORIENTATION
UNIT IV

ASSIGNMENT SHEET #7 — WRITE A FOLLOW-UP LETTER OR MAKE A FOLLOW-UP TELEPHONE CALL AFTER INTERVIEWING FOR A CARPENTRY JOB

NAME ______________________________ SCORE ______________

It is sometimes helpful to return to a business and check again on possible job openings. This is often done about a week after the first interview. This short, casual visit accomplishes two things. It helps the interviewer remember you, and it shows that you have a sincere interest in working for that company.

It is not always possible to have this type of informal atmosphere when applying for a job. However, it is always proper to send a follow-up letter or to make a follow-up telephone call.

PART I

Write a follow-up letter thanking the employer for the interview. Use any form you wish, or follow the format of the sample follow-up letter included in this assignment sheet. Use the information below as a guide.

Guidelines for Writing a Follow-Up Letter

A. Make sure that your letter meets the following standards

1. Typed or written perfectly
2. Clean, neat, and attractively arranged on the page
3. Free of spelling, punctuation, and grammatical errors
4. Sent within a day or two after the interview

B. Include the following points in your follow-up letter

1. Expression of appreciation for interviewer's time and interest
2. Summary of your qualifications and interest in position
3. Your name, address, and telephone number (to make it easier for your employer to contact you)

C. Make this last bid for the job a prime example of your excellent work habits; write a clean, neat, and well-worded letter

ASSIGNMENT SHEET #7

SAMPLE FOLLOW-UP LETTER

774 East Adams Street
Anytown, Yourstate 77704
September 3, 198—

Mr. John Jones
Personnel Director
Jones Construction Company
Box 19
Progressville, Yourstate 77802

Dear Mr. Jones:

Thank you for interviewing me for the job of rough framing carpenter with your company. I feel that working for Jones Construction Company would be enjoyable and that I could do the general rough framing work that the job requires. I hope that I will have the opportunity to prove my worth.

The application form you gave me is enclosed.

I will be available for work October 15. You may call me at my home after 3:30 P.M. The number is (800) 555-7779.

Sincerely yours,

Terry McKracken
Terry McKracken

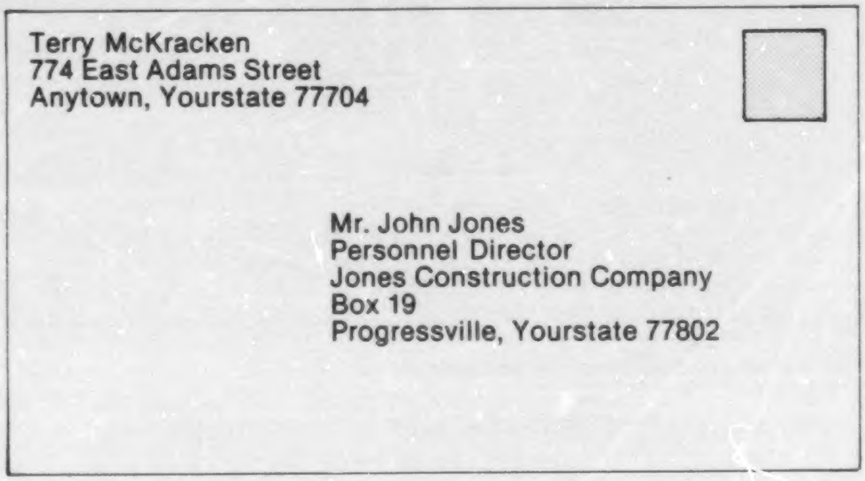
Enclosure

ASSIGNMENT SHEET #7

PART II

Address a legal-sized envelope and insert folded follow-up letter.

A. Type the address on the envelope exactly the same as the inside address of the letter

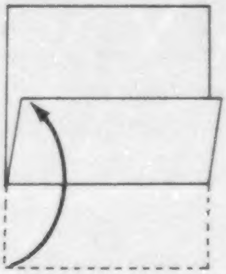


Terry McKracken
774 East Adams Street
Anytown, Yourstate 77704

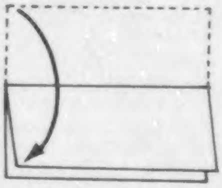
Mr. John Jones
Personnel Director
Jones Construction Company
Box 19
Progressville, Yourstate 77802

B. Fold letter

1. Fold slightly less than one-third of letter toward top

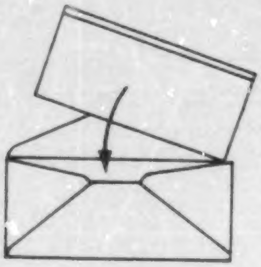


2. Fold down the top of letter to within ½ inch of bottom fold



ASSIGNMENT SHEET #7

C. Insert letter into envelope, with last crease toward bottom of envelope



PART III

Role-play a follow-up telephone call. Make sure to include the following information: your name, the date of your interview, and the position for which you were interviewed.

A. Ask whether a decision has been made

EXAMPLES:	Incorrect:	"Hello, Mr. Jones. This is Terry McKracken. You told me you would let me know about the job, but I haven't heard anything from you. Why haven't you called me?"
	Incorrect:	"This is Terry McKracken. Did I get the job?"
	Correct:	"Hello, Mr. Jones. This is Terry McKracken. I interviewed with you on September 15 for the position of rough framing carpenter. Have you made a decision on my application yet?"

B. If someone else has already been hired, thank the interviewer for considering you, but express continued interest in working for the company

EXAMPLES:	Incorrect:	"Oh well, that's my luck. Thanks anyway."
	Incorrect:	"I didn't want to work for your company anyway."
	Correct:	"I am sorry I was not hired. Thank you for considering my application. I am still interested in working for the company and would appreciate your keeping my application on file."

INDUSTRY ORIENTATION
UNIT IV

ASSIGNMENT SHEET #8 — COMPARE JOB OPPORTUNITIES

NAME ____ SCORE ________________

When you are offered a job, there are many factors to weigh before taking the position. Some of these factors include take-home pay, benefits that accompany the job, actual cost of being at work each day, how satisfying the job would be, and how the job would meet your needs and aspirations.

PART I

There are certain questions that you should ask yourself when weighing job opportunities. Part I of this assignment sheet outlines some of those questions. Using information from jobs for which you have applied or those in which you are interested, complete the following activities.

A. What benefits besides pay do I get from the job?

Some benefits associated with working are not always visible. Often some of these overlooked benefits are paid for in part by your employer. Obtain information about the benefits in the jobs you are considering. Be sure to note any benefits that must be paid for in part or completely by the employee. At the time of the interview, or when considering a position, ask about the following benefits:

1. Employer's contributions for your protection that may include
    - Health insurance
    - Unemployment compensation
    - Clothing and safety garments
    - Medical facilities and health tests
    - Pensions
    - Travel insurance (covering mishaps when traveling on business)
    - Educational programs or reimbursement for courses related to job
2. Sick leave with pay
3. Paid vacations and holidays

B. What is my take-home pay?

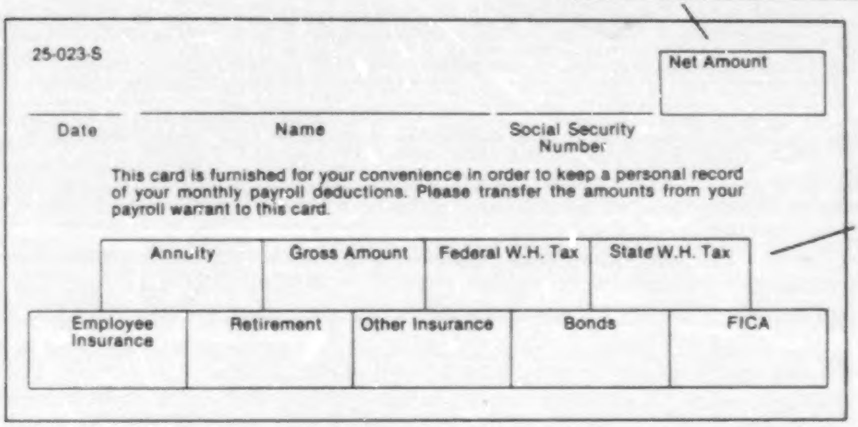
Salaries and wages are often quoted by employers as *gross earnings*. Gross earnings are used because tax deductions vary depending upon the number of dependents, the amount of earnings, and other information.

ASSIGNMENT SHEET #8

Optional benefits and deductions offered by an employer also differ. It is generally advisable to ask what programs are available, because such programs can affect the actual money you receive on payday.

Information about your earnings and withholdings is often recorded on a form such as the one shown below. Use the information about salary and payroll deductions provided by employers or by your instructor, along with tax information provided by your instructor, to determine take-home pay for the jobs you are considering.

NET PAY is the actual money you receive on payday after all required and optional deductions have been taken out.



25-023-S

Net Amount

Date

Name

Social Security Number

This card is furnished for your convenience in order to keep a personal record of your monthly payroll deductions. Please transfer the amounts from your payroll warrant to this card.

Annuity	Gross Amount	Federal W.H. Tax	State W.H. Tax

Employee Insurance	Retirement	Other Insurance	Bonds	FICA

Basic required deductions, federal tax, and social security

C. What will it cost to work at this job?

Frequently, the costs associated with being employed are overlooked. It may be of value to calculate estimated weekly expenses before making a decision about a job.

Estimate weekly expenses for

Transportation, gasoline (parking, bus fares) $_______

Lunches (cost of food eaten away from home, including soft drinks and coffee) $_______

Clothing (including cleaning) $_______

Child care $_______

Gifts for other employees $_______

Special uniforms, materials, or equipment for job $_______

Other $_______

TOTAL $_______

ASSIGNMENT SHEET #8

D. What is important to me in a job?

Take-home pay and benefits may be only part of what you want from a job. Think through other things you consider important in a job.

1. What have been some of your most rewarding job experiences? Why?

   a. ____

   b. ____

   c. ____

2. Rate the following in order of what is important to you, with "1" being the most important.

   _____a. Job security (little chance you will be released from the job)

   _____b. Opportunity for advancement

   _____c. Recognition for your work

   _____d. Good wages

   _____e. Opportunity to learn and use your ideas

   _____f. Flexible working conditions

   _____g. Long vacations

   _____h. Pleasant working conditions

   _____i. Interesting work

   _____j. Friendly co-workers

   _____k. Other, such as ______________________________

PART II

To reach a decision about whether you want the job or not, summarize the information you have gathered.

A. Would the job be satisfying to me? Why or why not?

____

ASSIGNMENT SHEET #8

B. What are the benefits that accompany the job?

____

____

C. How much will it actually cost to be at work each day?________________________

D. How would the job meet my needs and aspirations?

____

____

____

E. I estimate my take-home pay to be $__________________.

F. I estimate my expenses related to working to be $__________________.

G. I estimate my job benefits to be worth $__________________.

H. I would most enjoy the following about this job.

____

____

____

____

____

____

____

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INDUSTRY ORIENTATION
UNIT IV

ASSIGNMENT SHEET #9 — COMPLETE A W-4 FORM

NAME ________________________________ SCORE ______________

The law requires that any working person must complete a W-4 form so that employers can withhold federal income tax from employees' pay. Your W-4 form remains in effect until you change it or, if you entered "Exempt" on line 6b, until February 15 of next year. By correctly completing this form, you can fit the amount of tax withheld from wages to your tax liability.

Complete the W-4 tax form on the next page, using the guidelines below and information about yourself.

Guidelines for Completing a W-4 Form

A. Be prepared

B. Follow directions

C. Write or print clearly, neatly, and legibly

D. Answer all questions honestly

E. Include complete information

F. Recheck form when finished

G. Avoid crossing out and erasing

H. Do not write in boxes #7, #8, and #9

When you are sure the form is correct and complete, detach at the perforated line and give the top part to your employer (instructor); keep the lower part for your records and information.

ASSIGNMENT SHEET #9

Form **W-4**
(Rev. January 1985)

Department of the Treasury—Internal Revenue Service

Employee's Withholding Allowance Certificate

OMB No. 1545-0010
Expires 11-30-87

1 Type or print your full name	2 Your social security number
Home address (number and street or rural route) City or town, State, and ZIP code	3 Marital Status: ☐ Single ☐ Married ☐ Married, but withhold at higher Single rate **Note:** If married, but legally separated, or spouse is a nonresident alien, check the Single box

4 Total number of allowances you are claiming (from line F of the worksheet on page 2)

5 Additional amount, if any, you want deducted from each pay $

6 I claim exemption from withholding because (see instructions and check boxes below that apply):

- a ☐ Last year I did not owe any Federal income tax and had a right to a full refund of **ALL** income tax withheld, **AND**
- b ☐ This year I do not expect to owe any Federal income tax and expect to have a right to a full refund of **ALL** income tax withheld. If both a and b apply, enter the year effective and "EXEMPT" here ▶ Year
- c If you entered "EXEMPT" on line 6b, are you a full-time student? ☐ **Yes** ☐ **No**

Under penalties of perjury, I certify that I am entitled to the number of withholding allowances claimed on this certificate, or if claiming exemption from withholding, that I am entitled to claim the exempt status.

Employee's signature ▶ Date ▶ , 19

7 Employer's name and address (**Employer: Complete 7, 8, and 9 only if sending to IRS**)	8 Office code	9 Employer identification number

- - - - - - - - - - Detach along this line. Give the top part of this form to employer; keep the lower part for your records. - - - - - - - - - -

Changes You Should Note.—The value of each withholding allowance has increased to $1,040 and the income tax brackets have expanded to reflect indexing. Therefore, income tax withholding has decreased. If you claim withholding allowances for deductions and credits, you should check to be sure that enough tax is being withheld.

Privacy Act and Paperwork Reduction Act Notice.—If you do not give your employer a certificate, you will be treated as a single person with no withholding allowances as required by law. We ask for this information to carry out the Internal Revenue laws of the United States. We may give the information to the Dept. of Justice for civil or criminal litigation and to the States and the District of Columbia for use in administering their tax laws.

Purpose.—The law requires that you complete Form W-4 so that your employer can withhold Federal income tax from your pay. Your Form W-4 remains in effect until you change it or, if you entered "EXEMPT" on line 6b above, until February 15 of next year. By correctly completing this form, you can fit the amount of tax withheld from your wages to your tax liability.

If you got a large refund last year, you may be having too much tax withheld. If so, you may want to increase the number of your allowances on line 4 by claiming any other allowances you are entitled to. The kinds of allowances, and how to figure them, are explained in detail below.

If you owed a large amount of tax last year, you may not be having enough tax withheld. If so, you can claim fewer allowances on line 4, or ask that an additional amount be withheld on line 5, or both.

If the number of withholding allowances you are entitled to claim decreases to less than you are now claiming, you must file a new W-4 with your employer within 10 days.

The instructions below explain how to fill in Form W-4. **Publication 505,** Tax Withholding and Estimated Tax, contains more information on withholding. You can get it from most IRS offices.

For more information about who qualifies as your dependent, what deductions you can take and what tax credits you qualify for, see the Form 1040 Instructions.

You may be fined $500 if you file, with no reasonable basis, a W-4 that results in less tax being withheld than is properly allowable. In addition, criminal penalties apply for willfully supplying false or fraudulent information or failing to supply information requiring an increase in withholding.

Line-By-Line Instructions

Fill in the identifying information in Boxes 1 and 2. If you are married and want tax withheld at the regular rate for married persons, check "Married" in Box 3. If you are married and want tax withheld at the higher Single rate (because both you and your spouse work, for example), check "Married, but withhold at higher Single rate" in Box 3.

Line 4 of Form W-4

Total number of allowances.—Use the worksheet on page 2 to figure your allowances. Add the number of allowances for each category explained below. Enter the total on line 4.

If you are single and hold more than one job, you may not claim the same allowances with more than one employer at the same time. If you are married and both you and your spouse are employed, you may not both claim the same allowances with both of your employers at the same time. To have the highest amount of tax withheld, claim "0" allowances on line 4.

A. Personal allowances.—You can claim the following personal allowances:

1 for yourself, 1 if you are 65 or older, and 1 if you are blind.

If you are married and your spouse either does not work or is not claiming his or her allowances on a separate W-4, you may also claim the following allowances: 1 for your spouse, 1 if your spouse is 65 or older, and 1 if your spouse is blind.

B. Special withholding allowance.—Claim the special withholding allowance if you are single and have one job or you are married, have one job, and your spouse does not work. You may still claim this allowance so long as the total wages earned on other jobs by you or your spouse (or both) is 10% or less of the combined total wages. Use this special withholding allowance only to figure your withholding. Do not claim it when you file your return.

C. Allowances for dependents.—You may claim one allowance for each dependent you will be able to claim on your Federal income tax return.

Note: *If you are not claiming any deductions or credits or income averaging, skip D and E, add lines A, B, and C, enter the total on line F and carry the total over to line 4 of Form W-4.*

Note: *Before you claim allowances under D and E, total your non-wage taxable income (interest, dividends, self-employment income, etc.) and subtract this amount from estimated deductions you would otherwise enter in D1. If your non-wage income is greater than the amount of estimated deductions, you cannot claim any allowances under D. Moreover, you should take one-third of the excess (non-wage income over estimated deductions) and add this to the appropriate "A" value in Table 1 if determining allowances under E.*

D. Allowances for estimated deductions.—If you expect to itemize deductions, you may be entitled to additional withholding allowances. You may also use net losses shown on Schedules C, D, E, and F (Form 1040), the last line of Part II of Form 4797, any net operating loss carryover, charitable contributions for nonitemizers, and adjustments to income (such as IRA or Keogh contributions, employee business expenses, alimony payments, etc.). See Schedule A (Form 1040) for deductions you can itemize and see the Adjustments to Income section on page 1 of Form 1040 for a list of adjustments. Do not include reimbursed moving expenses or IRA contributions made by your employer unless income tax has been withheld on them by your employer. If no tax has been withheld on them and you claim additional allowances for them, you will be underwithheld. For details, see Publication 505.

The deduction allowed a married couple when both work is 10% of the lesser of $30,000 or the qualified earned income of the spouse with the lower income.

Once you have determined these deductions, enter the total on line D1 of the worksheet on page 2 and figure the number of withholding allowances for them.

E. Allowances for tax credits.—If you expect to take credits like those shown on the 1984 Form 1040 (child care, residential energy, etc.), use the table on the top of page 2 to figure the number of additional allowances you can claim. You may estimate these credits. Include the earned income credit only if you are not receiving advance payment of it. Also, if you expect to income average, include the amount of the reduction in tax because of averaging and any excess social security tax withheld when using the table.

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ASSIGNMENT SHEET #9

Line 5 of Form W-4

Additional amount, if any, you want deducted from each pay.—If you are not having enough tax withheld from your pay, you may ask your employer to withhold more by filling in an additional amount on line 5. Often, married couples, both of whom are working, and persons with two or more jobs need to have additional tax withheld. You may also need to have additional tax withheld because you have income other than wages, such as interest and dividends, capital gains, rents, alimony received, taxable social security benefits, etc. Estimate the amount you will be underwithheld and divide that amount by the number of pay periods in the year. Enter the additional amount you want withheld each pay period on line 5.

Line 6 of Form W-4

Exemption from withholding.—You can claim exemption from withholding only if last year you did not owe any Federal income tax and had a right to a refund of all income tax withheld, **and** this year you do not expect to owe any Federal income tax and expect to have a right to a refund of all income tax withheld. If you qualify, check Boxes 6a and b, write the year exempt status is effective and "EXEMPT" on line 6b, and answer Yes or No to the question on line 6c.

If you want to claim exemption from withholding next year, you must file a new W-4 with your employer on or before February 15 of next year. If you are not having Federal income tax withheld this year, but expect to have a tax liability next year, the law requires you to give your employer a new W-4 by December 1 of this year. If you are covered by social security, your employer must withhold social security tax.

Your employer must send to IRS any W-4 claiming more than 14 withholding allowances or claiming exemption from withholding if the wages are expected to usually exceed $200 a week. The employer is to complete Boxes 7, 8, and 9 only on copies of the W-4 sent to IRS.

Table 1—For Figuring Your Withholding Allowances for Estimated Tax Credits and Income Averaging (Line E)

Estimated Salaries and Wages from All Sources	Single Employees		Head of Household Employees		Married Employees (When Spouse not Employed)		Married Employees (When Both Spouses Are Employed)	
	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)
Under $15,000	$ 90	$160	$ 0	$160	$ 50	$130	$ 0	$130
15,000-25,000	120	260	0	260	60	180	310	180
25,001-35,000	160	320	0	320	150	240	770	230
35,001-45,000	240	390	0	390	200	300	1,380	260
45,001-55,000	610	390	0	390	200	350	2,100	320
55,001-65,000	1,260	390	110	390	300	390	2,890	350
Over 65,000	2,250	390	730	390	570	390	3,590	390

Worksheet to Figure Your Withholding Allowances To Be Entered on Line 4 of Form W-4

A Personal allowances ▶ A ______

B Special withholding allowance (not to exceed 1 allowance—see instructions on page 1) ▶ B ______

C Allowances for dependents ▶ C ______

If you are not claiming any deductions or credits or income averaging, skip lines D and E.

D Allowances for estimated deductions:

1 Enter the total amount of your estimated itemized deductions, alimony payments, qualified retirement contributions including IRA and Keogh (H.R. 10) plans, deduction for a married couple when both work, business losses including net operating loss carryovers, moving expenses, employee business expenses, penalty on early withdrawal of savings, and charitable contributions for nonitemizers for the year ▶ 1 $ ______

2 If you do not plan to itemize deductions, enter $520 on line D2. If you plan to itemize, find your total estimated salaries and wages amount in the left column of the table below. (Include salaries and wages of both spouses.) Read across to the right and find the amount from the column that applies to you. Enter that amount on line D2 ▶ 2 $ ______

Estimated salaries and wages from all sources:	Single and Head of Household Employees (only one job)	Married Employees (one spouse working and one job only)	Employees with more than one job or Married Employees with both spouses working¹
Under $20,000	$2,800	$3,900	35% of estimated salaries and wages
20,000-45,000	2,800	3,900	22% of estimated salaries and wages
45,001-60,000	8% of estimated salaries and wages	3,900	19% of estimated salaries and wages
Over $60,000	10% of estimated salaries and wages	7% of estimated salaries and wages	18% of estimated salaries and wages

3 Subtract line D2 from line D1 (But not less than zero) ▶ 3 $ ______

4 Divide the amount on line D3 by $1,040 (increase any fraction to the next whole number). Enter here ▶ D ______

E Allowances for tax credits and income averaging: use Table 1 above for figuring withholding allowances

1 Enter tax credits, excess social security tax withheld, and tax reduction from income averaging $ ______

2 Enter the column (A) amount from Table 1 for your salary range and filing status (single, etc.) However, enter 0 if you claim 1 or more allowances on line D4 $ ______

3 Subtract line 2 from line 1 (If zero or less, do not complete lines 4 and 5) $ ______

4 Find the column (B) amount from Table 1 for your salary range and filing status $ ______

5 Divide line 3 by line 4. Increase any fraction to the next whole number. This is the maximum number of withholding allowances for tax credits and income averaging. Enter here ▶ E ______

Example: A taxpayer who expects to file a Federal income tax return as a single person estimates annual wages of $12,000 and tax credits of $650. The $12,000 falls in the wage bracket of under $15,000. The value in column (A) is $90. Subtracting this from the estimated credits of $650 leaves $560. The value in column (B) is $160. Dividing $560 by $160 gives 3.5. Since any fraction is increased to the next whole number, show 4 on line E.

F Total (add lines A through E). Enter total here and on line 4 of Form W-4 ▶ F ______

---

¹ If you earn 10% or less of your total wages from other jobs or one spouse earns 10% or less of the couple's combined total wages, you can use the "Single and Head of Household Employees (only one job)" or "Married Employees (one spouse working and one job only)" table, whichever is appropriate.

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INDUSTRY ORIENTATION
UNIT IV

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1 — Completed to the satisfaction of the instructor

Assignment Sheet #2 — Completed to the satisfaction of the instructor

Assignment Sheet #3 — Completed to the satisfaction of the instructor

Assignment Sheet #4 — Completed to the satisfaction of the instructor

Assignment Sheet #5 — Completed to the satisfaction of the instructor

Assignment Sheet #6 — Completed to the satisfaction of the instructor

Assignment Sheet #7 — Completed to the satisfaction of the instructor

Assignment Sheet #8 — Completed to the satisfaction of the instructor

Assignment Sheet #9 — Completed to the satisfaction of the instructor

INDUSTRY ORIENTATION
UNIT IV

TEST

NAME ______________________________ SCORE ______________

1. List three levels of training for carpentry-related jobs.

   a. ______________________________

   b. ______________________________

   c. ______________________________

2. List five job opportunities open to skilled carpenters.

   a. ______________________________

   b. ______________________________

   c. ______________________________

   d. ______________________________

   e. ______________________________

3. Select from the following list personal attributes or attitudes that an employer looks for in an employee. Write an "X" in the blank before each correct answer.

   ______a. Personal grooming

   ______b. Knowledge of machinery

   ______c. Desire to work

   ______d. Alertness, quickness of mind

   ______e. Desire to improve one's financial status

   ______f. Enthusiasm and interest

   ______g. Knowledge and pride in the trade

   ______h. Dedication and dependability

   ______i. Desire to help others

   ______j. Honesty and integrity

TEST

4. List documents that an applicant may need to prepare when applying for a job.

   a. ____________________

   b. ____________________

   c. ____________________

   d. ____________________

(NOTE: Test questions 5 through 10 list the assignment sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

5. Write a résumé.

6. Write a letter of application.

7. Complete an employment application.

8. Make an interview appointment by telephone for a carpentry job.

9. Write a follow-up letter or make a follow-up telephone call after interviewing for a carpentry job.

10. Complete a W-4 form.

INDUSTRY ORIENTATION
UNIT IV

ANSWERS TO TEST

1. Answer should include any three of the following
    a. Preparation
    b. Apprenticeship
    c. Post-secondary
    d. Up-grading

2. Answer should include any five of the following
    a. Construction
    b. Construction management
    c. Training
    d. Lumber industry
    e. Prefabrication shops
    f. Remodeling, restoration, and maintenance
    g. Cabinet and furniture shops
    h. Mobile home construction
    i. Building materials and tool sales and service

3. c, d, f, g, h, i, j

4. a. Résumé
    b. Letter of application
    c. Job application
    d. Follow-up letter

5. Completed to the satisfaction of the instructor

6. Completed to the satisfaction of the instructor

7. Completed to the satisfaction of the instructor

8. Completed to the satisfaction of the instructor

9. Completed to the satisfaction of the instructor

10. Completed to the satisfaction of the instructor

SAFETY AND BASIC FIRST AID
UNIT V

UNIT OBJECTIVE

After completing this unit, the student should be able to practice safety on the job and perform basic first-aid treatment for accident victims. The student will show this knowledge by completing assignment sheets, job sheets, and unit test with a minimum score of 100 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match to their correct definitions terms associated with safety and basic first aid.
2. State job safety rules.
3. Match colors of the safety color code to their correct applications.
4. Match classes of fires to their correct descriptions.
5. Discuss why knowledge of first aid is important.
6. Arrange in order first-aid actions to follow in an emergency.
7. List carpentry-related injuries that require the administration of first aid.
8. Discuss symptoms of traumatic shock.
9. State measures to take for prevention of heat stroke, heat cramps, and heat exhaustion.
10. Distinguish between symptoms of heat stroke and heat exhaustion.
11. Identify pressure points to use to control bleeding from various areas of the body.
12. Classify burns by degree according to their symptoms.
13. List guidelines for administering first aid to a victim with an eye injury.
14. Discuss signs and symptoms of fractures.
15. List guidelines for administering first aid to a victim with a suspected fracture.
16. Demonstrate the ability to
    a. Perform first-aid treatment for simulated accident victims.
    b. Properly lift a heavy object.

SAFETY AND BASIC FIRST AID
UNIT V

SUGGESTED ACTIVITIES

I. Unit contents

  A. Objective sheet

  B. Suggested activities

  C. Supplements

    1. Supplement #1 — Safety Pledge

    2. Supplement #2 — Safety and First-Aid Crossword Puzzle

    3. Supplement #3 — General Directions for Giving First Aid

    4. Supplement #4 — How to Lift Safely

    5. Supplement #5 — Carpentry-Related Hazards

    6. Supplement #6 — How to Beat the Heat

  D. Transparency masters

    1. TM #1 — Types of Fire Extinguishers

    2. TM #2 — Standard Letter Symbols for Fire Extinguishers

    3. TM #3 — New Pictorial Symbols Used to Label Fire Extinguishers

    4. TM #4 — Fire Extinguisher Suitable for Class B and Class C Fires

    5. TM #5 — Fire Triangle

    6. TM #6 — Fire Tetrahedron

    7. TM #7 — Correct Way to Lift Heavy Objects

    8. TM #8 — Face and Skin Conditions in Heat Stroke and Heat Exhaustion

  E. Information sheet

  F. Assignment sheets

    1. Assignment Sheet #1 — Identify Job-Site and Shop Safety Violations

    2. Assignment Sheet #2 — Match Fire-Extinguisher Symbols to Given Types of Fires

    3. Assignment Sheet #3 — Analyze Case Studies to Determine Correct First-Aid Treatments

SUGGESTED ACTIVITIES

G. Answers to assignment sheets

H. Job sheets

1. Job Sheet #1 — Perform First-Aid Treatment for Simulated Accident Victims

2. Job Sheet #2 — Properly Lift a Heavy Object

I. Test

J. Answers to test

II. Instructor's guide

A. Review unit and plan presentation.

B. Order or obtain materials to supplement unit.

1. Films

(NOTE: Films "e" through "l" in the following list are available to Oklahoma teachers on a free-loan basis. Oklahoma teachers may order these films from the Curriculum and Instructional Materials Center, Oklahoma State Department of Vocational and Technical Education, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074. Out-of-state teachers must order from the addresses listed with the films.)

a. *Housekeeping Means Safe Keeping*. Color, 10 minutes, Journal Films, Inc., 1975. Available from Journal Films, Inc., 930 Pitner Avenue, Evanston, Illinois 60202.

(NOTE: This film begins by taking the audience to a typical plant where they are presented with a variety of housekeeping violations. The dangers of these violations are then forcefully dramatized in the slow-motion recreation of a painful and realistic accident.)

b. *Stop a Fire Before It Starts*. Color, 10 minutes, Journal Films, Inc., 1975. Available from Journal Films, Inc., 930 Pitner Avenue, Evanston, Illinois 60202.

(NOTE: In easy-to-understand laboratory demonstrations, this film shows how everyday materials become explosive in the presence of sparks, cigarettes, and so on. From the laboratory, the film moves to typical on-the-job locations where hazardous fire situations are encountered and their blazing conclusions displayed. Most importantly, viewers learn why these situations were hazardous and what could have been done to prevent these fires.)

SUGGESTED ACTIVITIES

c. *A New Way to Lift*. Color, 9 minutes, Journal Films, Inc., 1970. Available from Journal Films, Inc., 930 Pitner Avenue, Evanston, Illinois 60202.

(NOTE: This film, produced in conjunction with the National Safety Council, demonstrates body mechanics that apply to all lifting situations. By following these tips, students may avoid serious back injury.)

d. *The Industrial Weightlifter II*. Color, 11 minutes, Ruddel Films for Industrial Accident Prevention Association, Ontario and Canada Packers, Ltd., 1981. Available from International Film Bureau, Inc., 332 South Michigan Avenue, Chicago, Illinois 60604.

(NOTE: Visuals have been updated in this new version that illustrates correct techniques for lifting heavy objects to prevent injury.)

e. *An Option to See*. Color, 18 minutes, Oklahoma Society to Prevent Blindness, 1977. Available from Film Library, Oklahoma State Department of Vocational and Technical Education, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074.

(NOTE: This safety film stresses the importance of wearing safety glasses while working around machinery.)

f. *Don't Push Your Luck*. Color, 12 minutes, Harvest Films, Inc., 1978. Available from Harvest Films, Inc., 309 Fifth Avenue, New York, New York 10016.

(NOTE: In this film Bill Frank, an actual victim, recreates his real-life blinding accident. He delivers powerful safety messages to industrial employees and shows proper eye and face protection.)

g. *It's Up to You*. Color, 11 minutes, Harvest Films, Inc., 1960. Available from Harvest Films, Inc., 309 Fifth Avenue, New York, New York 10016.

(NOTE: This is an award-winning breakthrough film on eye safety.)

h. *Eye Injuries*. Color, 6 minutes, International Film Bureau, 1981. Available from International Film Bureau, Inc., 332 South Michigan Avenue, Chicago, Illinois 60604.

(NOTE: This film demonstrates the procedure for removing particles from under the eyelids.)

i. *On Every Hand*. Color, 10 minutes, Journal Films, Inc., 1970. Available from Journal Films, Inc., 930 Pitner Avenue, Evanston, Illinois 60202.

(NOTE: This film demonstrates how to avoid serious hand injuries that could be caused by commonly used and dangerous equipment.)

SUGGESTED ACTIVITIES

j. *How to Avoid 16 Leading Causes of OSHA Citations*. Color, 20 minutes, Bureau of Business Practice, 1978. Available from Bureau of Business Practice, 24 Rope Ferry Road, Waterford, Connecticut 06386.

(NOTE: This film shows the most common OSHA violations and tells how to avoid them.)

k. *Safety in the Shop: Basic Practices*. Black and white, 13 minutes, Coronet Films, 1970. Available from Coronet Films, 65 East South Water Street, Chicago, Illinois 60601.

(NOTE: This film emphasizes the worker's responsibility for safety in using hand and power tools. It explains the importance of a clean shop, proper clothing, correct ways to lift, and ways to guard against fires.)

l. *Danger Zone: Your Back*. Color, 18 minutes, Visucom Productions, 1981. Available from Visucom Productions, P. O. Box 5472, Redwood City, California 94063.

(NOTE: This safety film demonstrates good lifting, pulling, and pushing practices and is designed to motivate employees to participate in accident prevention.)

2. Safety signs, posters, and other films or filmstrips

(NOTE: Various safety educational material and filmstrips are available from Underwriters Laboratories, Inc., Public Information and Education Services, 207 East Ohio Street, Chicago, Illinois 60611.)

3. Full-color transparencies from the unit "Fire Behavior" in the IFSTA manual *Essentials of Fire Fighting*

(NOTE: This box of seventeen transparencies covering the burning process includes a plastic universal mount and an interleaf of each transparency for use by the instructor in a teaching outline. This set of transparencies is available from Fire Protection Publications, Oklahoma State University, Stillwater, Oklahoma 74078, or call toll-free 800-654-4055.)

4. Transparencies, competency profiles, and shop safety signs

(NOTE: Transparencies, competency profiles, and shop safety signs for this book are available from The Associated General Contractors of America, 1957 E Street N.W., Washington, D.C. 20006, or from the Oklahoma State Department of Vocational and Technical Education, Curriculum and Instructional Materials Center, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074.)

SUGGESTED ACTIVITIES

C. Introduce unit by stressing the importance of safety and first aid, particularly as related to the carpentry trade.

SUGGESTIONS:

- Explain how safe practices and habits may prevent injuries, loss of equipment, and loss of materials; and may even save lives.
- Discuss the Good Samaritan Act. Is it active in your community? How active is it? What persons does it specifically cover?
- Use instances that you know of or have heard about, or use case studies, to point out the importance of knowing how to administer first aid.
- Have each student complete and sign a copy of Supplement #1, "Safety Pledge." Collect and file.

D. Provide students with objective sheet. Discuss unit and specific objectives, pointing out that the safety and first-aid material in this unit is important enough to require a score of 100 percent on the unit test.

E. Provide students with information, assignment, and job sheets.

F. Discuss information, assignment, and job sheets.

1. Use Information Sheet, Section I to introduce students to terms and definitions associated with safety and first aid.

   SUGGESTIONS:

   - Explain how knowing the terms and definitions will help the student understand and grasp the importance of this unit.
   - Have students review terms associated with safety and first aid by completing Supplement #2, "Safety and First-Aid Crossword Puzzle."

2. Use Information Sheet, Section II to discuss job safety rules.

   SUGGESTIONS:

   - Discuss OSHA and other regulatory acts and agencies.
   - Show films *Safety in the Shop: Basic Practices*, *Housekeeping Means Safe Keeping*, and *How to Avoid 16 Leading Causes of OSHA Citations*.
   - Demonstrate any safety procedures and explain any safety policies applicable to your specific equipment or shop.

SUGGESTED ACTIVITIES

- Ask students to explain why personal and job safety rules are important. Have them list possible consequences of not following these rules.

- Stress the consequences of practical jokes on the job. Point out that employers do not want cheerless or humorless workers, but that they do want responsible employees who know the right time and place for humor. Explain how some people have lost their jobs because they engaged in horseplay or played practical jokes during working hours.

- Explain how horseplay and practical jokes around power equipment increase the possibility of accidents.

- Set up work schedules and shop clean-up procedures, and explain to students. Post these schedules on the bulletin board.

- Explain procedures for disposing of waste and scrap materials.

- Discuss proper use of cleaning equipment and supplies, demonstrating special cleaning procedures or techniques specific to your equipment or shop.

- Have students practice identifying job-site and shop safety violations by completing Assignment Sheet #1.

3. Use Information Sheet, Section III to discuss the safety color code and its applications.

SUGGESTIONS:

- Ask if anyone in the class is colorblind (unable to distinguish between certain colors such as red and green). Take colorblind students on a special tour of the shop and work area, pointing out specific locations and applications for safety colors.

- List colors of the safety color code, and have students find and list applications of each in the shop and at the work site.

4. Use Information Sheet, Section IV and Transparencies #1 through #4 to discuss classes of fires and types of fire extinguishers. Stress the importance of knowing the different classes of fires and the correct type of fire extinguisher to use for each.

SUGGESTIONS:

- Have students locate and read the labels on each of the fire extinguishers in the shop area, listing the class or classes of fire each should be used on.

SUGGESTED ACTIVITIES

- Invite a fire fighter to the class to explain and to demonstrate the proper use of the various types of fire extinguishers.

- Show film *Stop a Fire Before It Starts.*

- Use Fire Protection Services transparencies and Transparencies #5 and #6 to explain the burning process.

- Have students practice selecting the correct fire extinguisher by completing Assignment Sheet #2.

5. Discuss Information Sheet, Sections V and VI, stressing the importance of knowing the steps to follow and the correct sequence of these steps when giving first aid to an accident victim.

   SUGGESTIONS:

   - Supplement your discussion with material from the American Red Cross books *Standard First Aid and Personal Safety* and *Multimedia Standard First Aid Student Workbook*. Encourage students to obtain their own copies of these manuals for home and work-site reference. Both manuals are available from the American Red Cross, 17th and D Streets, Washington, D. C. 20006.

   - Provide each student with a copy of Supplement #3 to use for quick reference.

   - Show films *An Option to See, Don't Push Your Luck, It's Up to You*, and *On Every Hand.*

   - Invite a resource person to speak to the class on first-aid techniques.

   - Encourage students to take American Red Cross CPR and first-aid courses for certification.

   - Have students practice using appropriate first-aid techniques by completing Job Sheet #1.

6. Use Information Sheet, Section VII to discuss carpentry-related injuries that require the administration of first aid. Stress proper procedures for lifting heavy objects.

   SUGGESTIONS:

   - Use Supplement #4, "How to Lift Safely," and Transparency #7 to illustrate your discussion.

SUGGESTED ACTIVITIES

- Show films *A New Way to Lift*, *The Industrial Weightlifter II*, and *Danger Zone: Your Back*.
- Provide students with copies of Supplement #5, "Carpentry-Related Hazards." Discuss.
- Demonstrate procedures outlined in Job Sheet #2, and then have students complete Job Sheet #2.

7. Use Information Sheet, Section VIII to discuss traumatic shock, stressing that such shock can be life-threatening unless treated.

SUGGESTION:

- Demonstrate and discuss procedure for treating shock as outlined in Job Sheet #1.

8. Discuss Information Sheet, Sections IX and X, stressing prevention of heat stroke and heat exhaustion.

SUGGESTIONS:

- Use Transparency #8 to illustrate your discussion.
- Make copies of Supplement #6 to post on the bulletin board or to hand out to students for future reference. Discuss.
- Discuss the need to drink plenty of water to prevent dehydration and possible heat stroke or heat exhaustion. Water is better than sweet or electrolyte drinks because water leaves the stomach faster and is more quickly available for the tissues. Discuss also the need for increasing one's salt intake and eating a balanced diet. Using a little extra table salt can help replace sodium and chloride lost through heavy perspiration. Salt tablets are not recommended. A balanced diet of whole-grain cereals, fruits, vegetables, milk, meat, poultry, and fish will supply potassium and other mineral elements lost through heavy perspiration.

9. Use Information Sheet, Section XI to explain the correct pressure points to use to control bleeding.

SUGGESTIONS:

- Remind students that pressure points are used only when bleeding cannot be controlled by direct pressure.
- Have students study Supplement #5, "Carpentry-Related Hazards," to determine which situations present a bleeding hazard.
- Relate incidents from your experience, or give case studies, to illustrate the importance of controlling bleeding by direct pressure.
- Remind students that bleeding victims should be observed for signs of shock and treated accordingly.

SUGGESTED ACTIVITIES

- Explain the difference between arterial and venous bleeding: arterial bleeding is bright red and spurts or flows intermittently; venous bleeding is dark red and flows continuously. *Immediate* steps must be taken to stop arterial blood flow, as this is a life-threatening situation. Often even heavy pressure to a pressure point is ineffective in stopping arterial bleeding. In such cases, the severed artery must be found and pinched closed with the fingers. Direct pressure is usually effective in controlling venous bleeding.

- Demonstrate the steps for controlling bleeding by direct pressure outlined in Job Sheet #1. Have students practice applying pressure to simulated bleeding (both arterial and venous) on various parts of the body by completing appropriate section of Job Sheet #1.

- Caution students that tourniquets are used ONLY as a last resort. Explain that while a tourniquet may be necessary to save a person's life, it cuts off circulation and may cost the victim his or her limb. Stress that if a tourniquet *must* be used, the victim must be seen by a physician as soon as possible.

- Explain what to do if the victim has severed a finger, hand, or limb. Tell students that bleeding should be controlled by applying pressure to the correct pressure point, and that the severed appendage should be wrapped in a clean cloth or placed in a clean plastic bag and be transported to the hospital with the victim. If possible, the appendage should also be kept cool with ice; but the ice must not be allowed to directly touch the appendage.

10. Use Information Sheet, Section XII to discuss symptoms of first-, second-, and third-degree burns.

    SUGGESTIONS:

    - Stress that immediate care of a burn victim may be the deciding factor in the severity of the injury.

    - Point out situations and areas of the shop and work site that have a potential for burns.

    - Demonstrate and have students complete appropriate section of Job Sheet #1.

11. Use Information Sheet, Section XIII to discuss the administration of first aid for eye injuries.

    SUGGESTIONS:

    - Show film *Eye Injuries*.

    - Stress that the whole eye may be damaged in a serious injury and that vision may be lost. The sooner medical care is obtained, the greater the chances for saving the victim's sight.

SUGGESTED ACTIVITIES

- Demonstrate and have students complete appropriate section of Job Sheet #1.

12. Use Information Sheet, Sections XIV and XV to discuss signs and symptoms of fractures and guidelines for treating suspected fractures.

    SUGGESTIONS:

    - Discuss the differences between open and closed fractures, both in treatment and signs and symptoms.
    - Remind students that when they cannot tell whether a person is suffering from a fracture or a sprain they should *always* assume that the injury is a fracture and treat it as such.
    - Invite a member of the local Red Cross chapter to come to class to demonstrate different types of splints and splinting techniques. Have this person also demonstrate correct procedures for immobilizing a person with a suspected neck or back fracture.
    - Demonstrate and have students complete appropriate section of Job Sheet #1.

G. Review safety rules several times during the duration of the training program.

H. Have students complete Assignment Sheet #3.

(NOTE: Assignment Sheet #3 should be given to students only after they have reviewed the information sheet and completed the job sheets and Assignment Sheets #1 and #2. It should be treated as a practice exercise where students apply the knowledge they have gained from the entire training program.)

I. Post appropriate warning signs and operating procedures near equipment.

J. Caution students that noncompliance with safety rules will result in disciplinary action.

K. Urge students to read and use supplements furnished with this unit.

L. Give test.

M. Critique test and discuss in class.

N. Reteach and retest if necessary.

O. Complete appropriate section of competency profiles.

SUGGESTED ACTIVITIES

III. Unit references

A. *Accident Prevention Manual for Industrial Operations,* 7th ed. Chicago, Illinois: National Safety Council, 1974.

B. American Red Cross. *Standard First Aid and Personal Safety*, 2nd ed. Garden City, New York: Doubleday and Company, Inc., 1979.

C. *An Accident Prevention Program for School, Shops, and Laboratories*. State College, Pennsylvania: Department of Vocational Education/Pennsylvania State University, 1967.

D. Carlson, Gene P. and William J. Vandervort, eds. *Essentials of Fire Fighting*, 2nd ed. Stillwater, Oklahoma: Fire Protection Publications, Oklahoma State University, 1983.

E. *Federal Register*. Vol. 36, No. 105, Pt. 2. Washington, D.C.: United States Department of Labor, 29 May 1971.

F. *First Aid*. Washington, D. C.: United States Department of Labor, Bureau of Mines, 1978.

G. Hendrix, Laborn J. "Bud." *Heavy Equipment Operator Instructional Materials, Basic Core*. Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and The Associated General Contractors of America, 1981.

H. *Manual of Accident Prevention in Construction*. Washington, D.C.: The Associated General Contractors of America, 1971.

I. *Rubber-Tired Front End Loader and Forklift Truck Accident Prevention. Mesa Instruction Guide 30*. Washington, D. C.: United States Department of the Interior, Mining Enforcement and Safety Administration, 1975.

J. *Safety Practices and Procedures in School Shops*. Trenton, New Jersey: Department of Education/Division of Vocational Education, n.d.

K. Smith, Earl. *Power Line Technician*. Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1978.

SUGGESTED ACTIVITIES

SUPPLEMENT #1 — SAFETY PLEDGE

Safety Pledge

It is understood that each student/employee will be given proper instruction in the use of the equipment and in the correct safety procedures concerning the equipment before she or he will be allowed to operate it. The student/employee must assume responsibility for following safe practices. We, therefore, ask that the student/employee subscribe to the following safety pledge.

I will follow all safety rules.

I will never use a machine without first having permission from my instructor or supervisor.

I will not ask permission to use a particular machine unless I have been instructed in its use and have scored 100 percent on the safety test for that machine.

I will report immediately any accident or injury, no matter how minor, to my instructor or supervisor.

Student's/employee's signature________________________________ Date__________

Manager's signature________________________________ Date__________

Supervisor's or instructor's signature________________________________ Date__________

Parent's or guardian's signature________________________________ Date__________

(Parental consent is necessary if the student/employee is under 18.)

SUGGESTED ACTIVITIES

SUPPLEMENT #2 — SAFETY AND FIRST-AID CROSSWORD PUZZLE

Test yourself on safety and first-aid terminology by using the clues below to complete the following crossword puzzle. Clue 57 Down has been done for you.

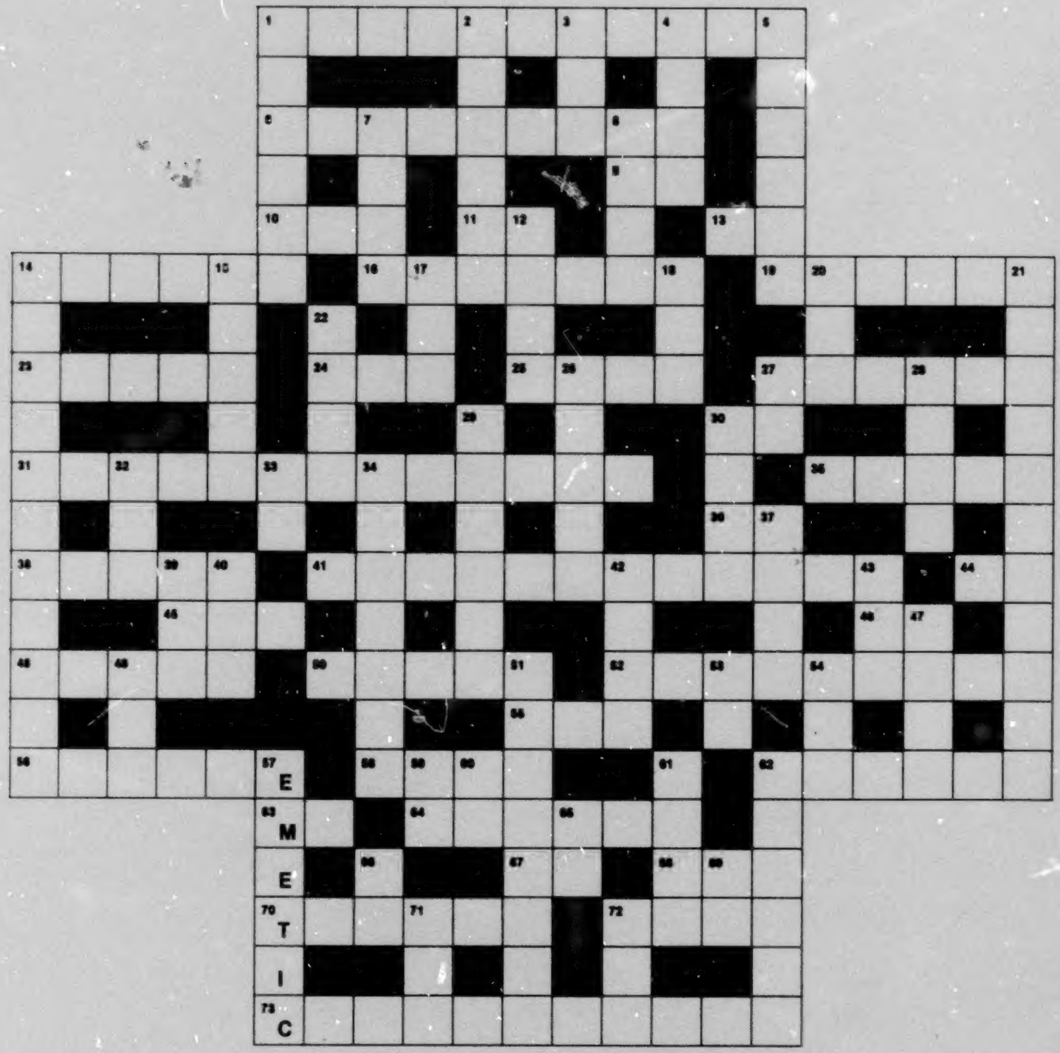
ACROSS

1. Guidelines for job safety (2 wds.)
6. Suddenly occurring unintentional events that cause injury or property damage
9. Exists
10. Long, thin fish
11. Northwest Territories (abbr.)
13. Atop
14. Source of danger
16. Intensity indicators for first- second- and third-
19. Muscular organ in mouth
23. Combustible substance in Class D fire
24. Cardiopulmonary resuscitation (abbr.)
25. Fracture associated with open wound
27. Explode; burst violently
30. "To be or not to . . ."
31. Act of reviving a person by bringing person back to full consciousness
35. Common blood group
36. Route (abbr.)
38. Substance in fire extinguisher used on Class A and Class B fires
41. Negligence; failure to think before one acts
44. 101 Roman
45. Word of negation
46. Pennsylvania (abbr.)
48. Federal safety color designating location of first-aid equipment
50. Indication of fire
52. Capable of being easily ignited
55. Untruth
56. Life-threatening disorder caused by prolonged exposure to intense heat
58. Tender; painful
62. Freedom from danger, risk, or injury
63. Physician's degree
64. Resuscitate
67. Article
68. Health resort with mineral springs
70. Complaint of victim in shock from hemorrhage
72. Wound made by piercing with a sharp instrument
73. Capable of bursting into flames

DOWN

1. What all metal containers for flammable materials should be
2. "Good —s to all"
3. The worst thing to do if your clothing or hair catches fire
4. Shock can be caused by — of blood
5. Device to prevent fractured bones and adjacent joints from moving
7. Water temperature for treatment of second-degree burn
8. To become in need of rest; to become weary
12. Group of three
14. Heavy loss of blood
15. Guidelines
17. Organ of hearing
18. Cause of 56 Across
20. Flammable liquid
21. Violently and loudly
22. 1151 Roman
26. What one should never do to an open fracture
27. State-of-being verb
28. — up spills immediately
29. Long, thin mark of different color than surrounding area
30. Injury caused by contact with heat, steam, electricity, or flame
32. Spanish word for 18 Down
33. Cubic centimeter (abbr.)
34. Bodily injuries, wounds, or shock
37. Group that works together toward a common goal
39. Unit
40. Prefix meaning *not*
42. Free of danger, secure
43. Identical twin of 68 Across
47. Capable
49. Ever (poetic)
51. Raises, as for an injured or bleeding limb
53. Fire extinguisher to use on flammable liquids and ordinary combustibles
54. Actress Farrow
57. Substance used to cause vomiting of some poisons
59. Either –; neither, nor
60. Prefix meaning *again*
61. Inactivity after work or exertion
62. Not changing
65. Within; inside
66. Prefix meaning *two*
69. Father (slang)
71. Action that eases heat cramps
72. Science fiction; –fi

SUPPLEMENT #2



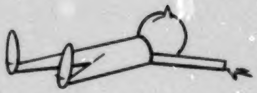
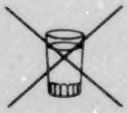
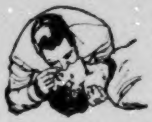
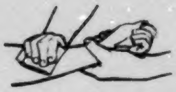
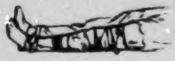
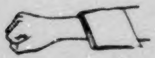
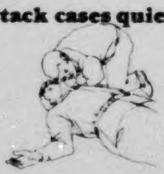
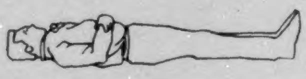
SOLUTION TO SUPPLEMENT #2

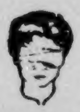
					1 S	A	F	E	2 T	Y	3 R	U	4 L	E	5 S					
					E	■	■	■	I	■	U	■	O	■	P					
					6 A	C	7 C	I	D	E	N	8 T	S	■	L					
					L	■	O	■	I	■	■	9 I	S	■	I					
					10 E	E	L	■	11 N	12 T	■	R	■	13 O	N					
14 H	A	Z	A	15 R	D	■	16 D	17 E	G	R	E	E	18 S	■	19 T	20 O	N	G	U	21 E
E	■	■	■	U	■	22 M	■	A	■	I	■	■	U	■	■	I	■	■	■	X
23 M	E	T	A	L	■	24 C	P	R	■	25 O	26 P	E	N	■	27 B	L	O	28 W	U	P
O	■	■	■	E	■	L	■	■	29 S	■	R	■	■	30 B	E	■	■	I	■	L
31 R	E	32 S	U	S	33 C	I	34 T	A	T	I	O	N	■	U	■	35 T	Y	P	E	O
R	■	O	■	■	C	■	R	■	R	■	B	■	■	36 R	37 T	■	■	E	■	S
38 H	A	L	39 O	40 N	■	41 C	A	R	E	L	E	42 S	S	N	E	S	43 S	■	44 C	I
A	■	■	45 N	O	T	■	U	■	A	■	■	A	■	■	A	■	46 P	47 A	■	V
48 G	R	49 E	E	N	■	50 S	M	O	K	51 E	■	52 F	L	53 A	M	54 M	A	B	L	E
E	■	E	■	■	■	■	A	■	■	55 L	I	E	■	B	■	I	■	L	■	L
56 S	T	R	O	K	57 E	■	58 S	59 O	60 R	E	■	■	61 R	■	62 S	A	F	E	T	Y
					63 M	D	■	64 R	E	V	65 I	V	E	■	T					
					E	■	66 B	■	■	67 A	N	■	68 S	69 P	A					
					70 T	H	I	71 R	S	T	■	72 S	T	A	B					
					I	■	■	U	■	E	■	C	■	■	L					
					73 C	O	M	B	U	S	T	I	B	L	E					

SUGGESTED ACTIVITIES

SUPPLEMENT #3 — GENERAL DIRECTIONS FOR GIVING FIRST AID

American
Red Cross

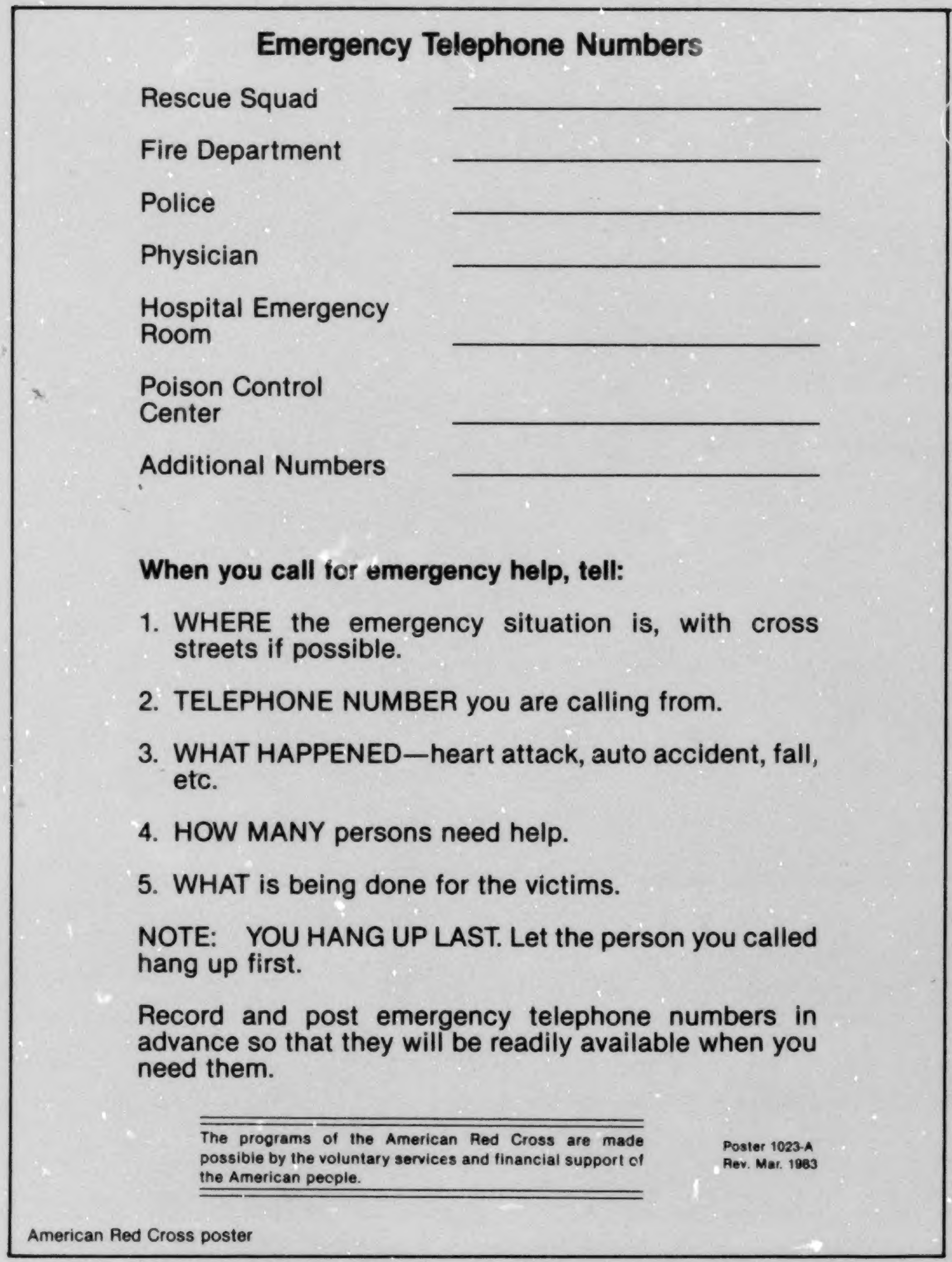
Keep the injured person lying down.  **Do not give liquids to an unconscious person.**  **Restart breathing with mouth-to-mouth artificial respiration.**  **Control bleeding by pressing on the wound.**  **Dilute swallowed poisons** **and call the Poison Control Center. Keep broken bones from moving.**  **Cover burns with thick layers of cloth.**  **Keep heart-attack cases quiet and give cardiopulmonary resuscitation (CPR) if it is necessary**  **and if you have been trained. Keep a fainting victim lying flat.** 

For eye injuries, pad and bandage both eyes.  **Always call a doctor.**

For more information about these and other lifesaving techniques, contact your Red Cross chapter.

American Red Cross poster

SUPPLEMENT #3



Emergency Telephone Numbers

Rescue Squad ____________________

Fire Department ____________________

Police ____________________

Physician ____________________

Hospital Emergency Room ____________________

Poison Control Center ____________________

Additional Numbers ____________________

When you call for emergency help, tell:

1. WHERE the emergency situation is, with cross streets if possible.
2. TELEPHONE NUMBER you are calling from.
3. WHAT HAPPENED—heart attack, auto accident, fall, etc.
4. HOW MANY persons need help.
5. WHAT is being done for the victims.

NOTE: YOU HANG UP LAST. Let the person you called hang up first.

Record and post emergency telephone numbers in advance so that they will be readily available when you need them.

The programs of the American Red Cross are made possible by the voluntary services and financial support of the American people.

Poster 1023-A
Rev. Mar. 1983

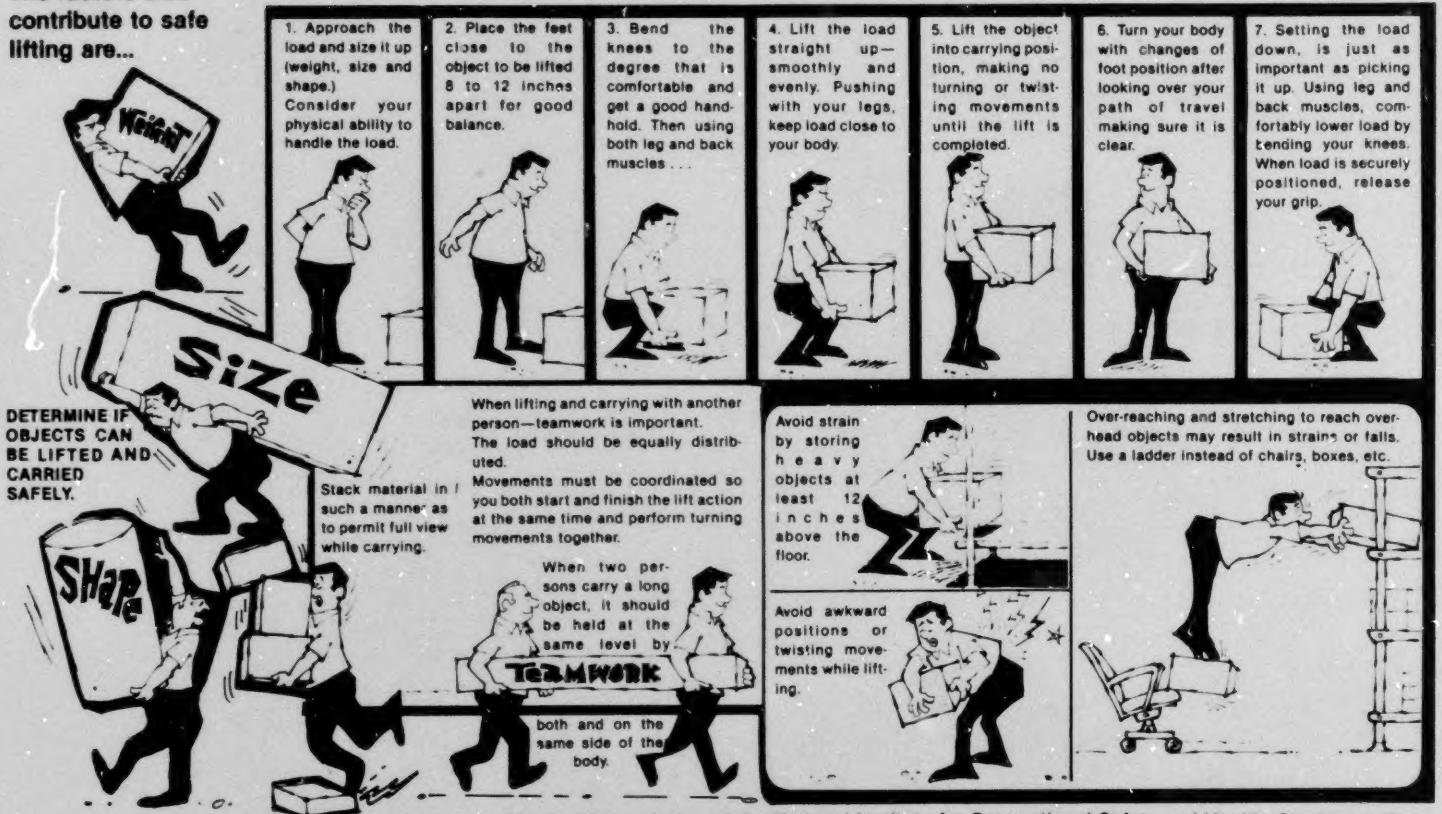
American Red Cross poster

SUPPLEMENT #4 — HOW TO LIFT SAFELY

HOW TO LIFT SAFELY

The following safe practices should be observed in order to avoid injury.

The factors that contribute to safe lifting are...



1. Approach the load and size it up (weight, size and shape.) Consider your physical ability to handle the load.

2. Place the feet close to the object to be lifted 8 to 12 inches apart for good balance.

3. Bend the knees to the degree that is comfortable and get a good hand-hold. Then using both leg and back muscles . . . .

4. Lift the load straight up—smoothly and evenly. Pushing with your legs, keep load close to your body.

5. Lift the object into carrying position, making no turning or twisting movements until the lift is completed.

6. Turn your body with changes of foot position after looking over your path of travel making sure it is clear.

7. Setting the load down, is just as important as picking it up. Using leg and back muscles, comfortably lower load by bending your knees. When load is securely positioned, release your grip.

DETERMINE IF OBJECTS CAN BE LIFTED AND CARRIED SAFELY.

Stack material in such a manner as to permit full view while carrying.

When lifting and carrying with another person—teamwork is important.
The load should be equally distributed.
Movements must be coordinated so you both start and finish the lift action at the same time and perform turning movements together.

When two persons carry a long object, it should be held at the same level by both and on the same side of the body.

Avoid strain by storing heavy objects at least 12 inches above the floor.

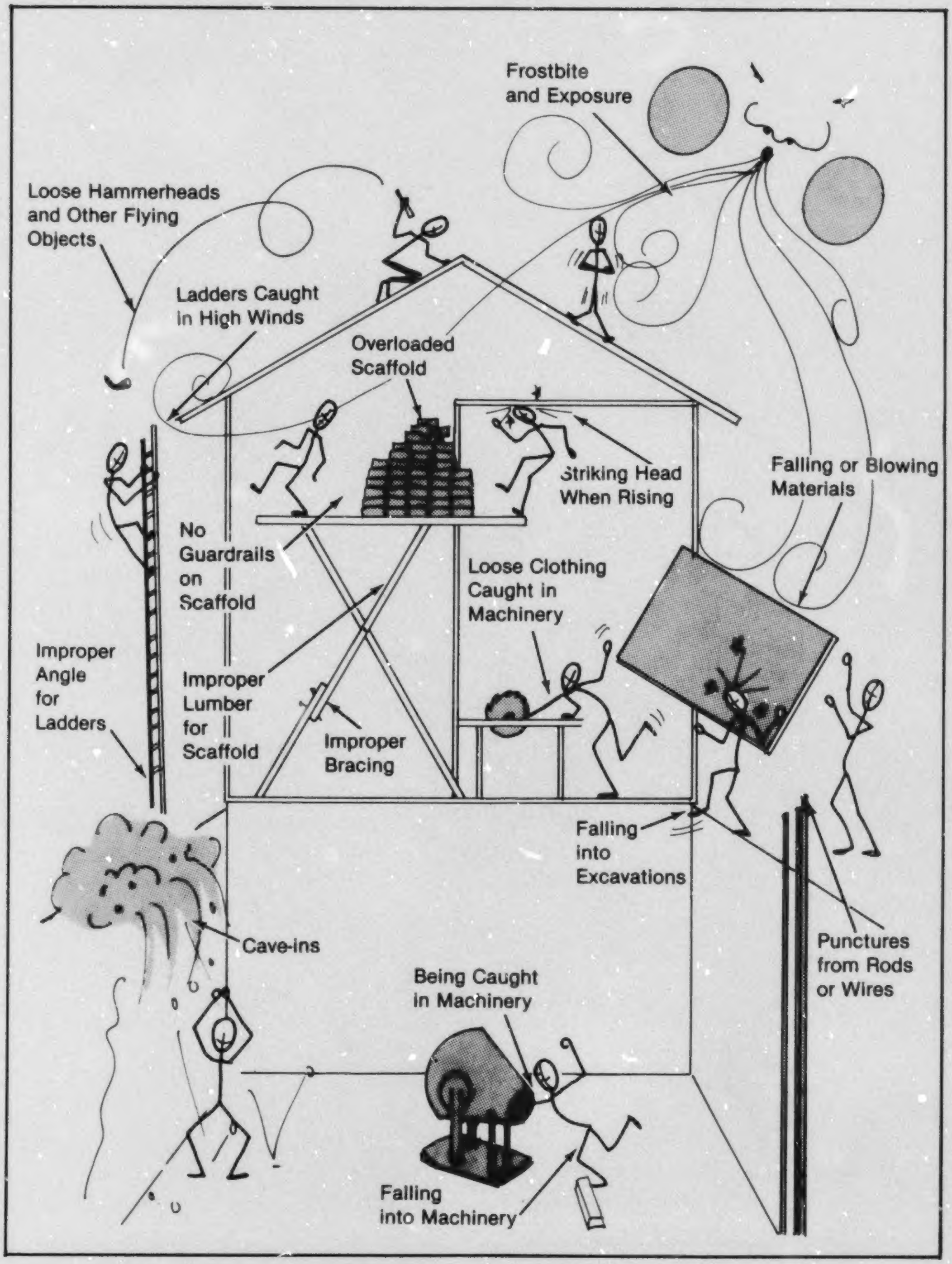
Avoid awkward positions or twisting movements while lifting.

Over-reaching and stretching to reach overhead objects may result in strains or falls. Use a ladder instead of chairs, boxes, etc.

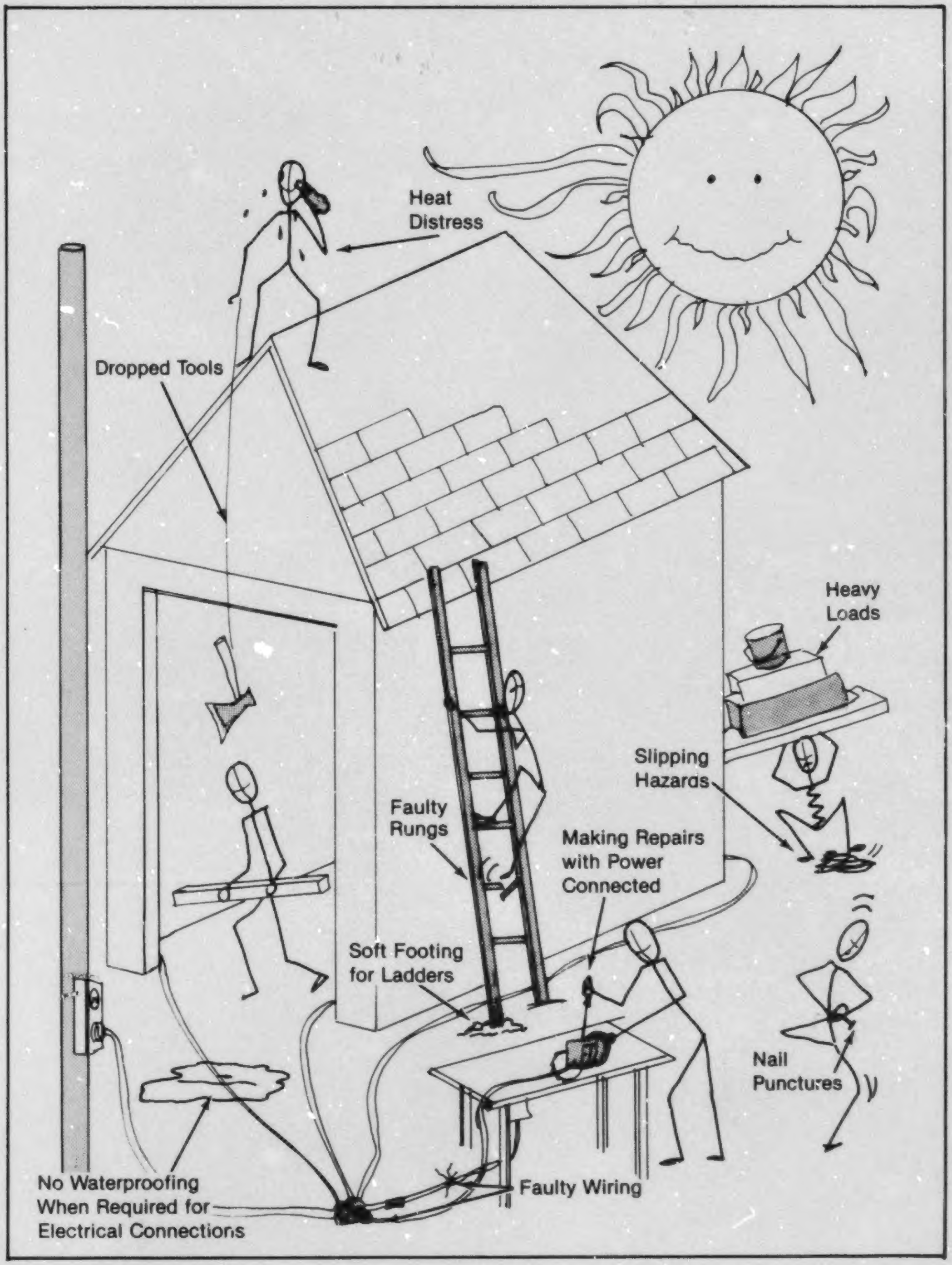
Used with permission of the National Institute for Occupational Safety and Health, Cincinnati, Ohio.

SUGGESTED ACTIVITIES

SUPPLEMENT #5 — CARPENTRY-RELATED HAZARDS


Frostbite and Exposure
Loose Hammerheads and Other Flying Objects
Ladders Caught in High Winds
Overloaded Scaffold
Striking Head When Rising
Falling or Blowing Materials
No Guardrails on Scaffold
Loose Clothing Caught in Machinery
Improper Angle for Ladders
Improper Lumber for Scaffold
Improper Bracing
Falling into Excavations
Cave-ins
Punctures from Rods or Wires
Being Caught in Machinery
Falling into Machinery

SUPPLEMENT #5


Heat
Distress
Dropped Tools
Heavy
Loads
Slipping
Hazards
Faulty
Rungs
Making Repairs
with Power
Connected
Soft Footing
for Ladders
Nail
Punctures
No Waterproofing
When Required for
Electrical Connections
Faulty Wiring

SUGGESTED ACTIVITIES

SUPPLEMENT #6 — HOW TO BEAT THE HEAT

HOW TO BEAT THE HEAT

Reactions to hot weather vary with a person's age, general physical condition, and activity level. Older people, small children and very active young people are the most likely to suffer from heat illness.

The human body is capable of adapting itself to varying temperature conditions, but the combined effect of heat and heavy physical exertion may be too much for the body's natural temperature regulator. Heat can make some people sick, and in some cases, it can kill.

Here's what happens. The body itself produces metabolic heat — more heat when you're working or playing than when resting. Outdoors on a sunny day, radiant energy adds heat to the body. If the air is warmer than the body temperature, more heat may be added.

The body's heat regulation system tries to maintain a fairly constant temperature of about 98°F. To cool the body, the heart pumps blood out to the extremities—arms and legs—where the heat is dispersed. Another way the body eliminates heat is through the cooling evaporation of sweat. A cool breeze and low humidity help body cooling. High humidity interferes with sweating and adds to discomfort.

Some of the more common forms of heat illness are as follows:

HEAT SYNCOPY OR HEAT FAINTING

This is common among people who are not acclimated to hot weather. It normally occurs soon after someone goes out into the heat to work or exercise. The blood pressure falls suddenly as blood flows to the extremities to cool the body and not enough goes to the head. The person feels giddy, light headed and then passes out. The best first aid is to have the person lie down to rest and elevate the feet.

HEAT CRAMPS

These muscular cramps result from exposure to high temperatures for a relatively long period of time, coupled with physical exertion. Heavy sweating and dehydration usually precede the cramps.

HEAT EXHAUSTION

This occurs after some hours in the sun and is related to loss of water and salt through sweating without sufficient fluid replacement. Common symptoms include a subnormal body temperature; pallor; dizziness; profuse sweating; cool, moist skin; nausea and headaches. The best first aid is to have the person rest in a cool place and drink water or fruit juice. If the person doesn't feel better in an hour or two or can't hold liquids, take him/her to a hospital emergency room.

HEAT STROKE

This condition can prove to be fatal, so immediate medical attention is necessary. It is caused by a complete breakdown of the body's heat regulating system, with heat production exceeding heat loss. Common symptoms include hot, dry skin, little or no sweating, severe headache, visual disturbance, rapid temperature rise, loss of consciousness, flushed face, weakness and confusion.

First aid treatment should be aimed at cooling the body quickly and getting the victim to the hospital. Remove the person from the source of heat, loosen the clothing, and try to cool the body as rapidly as possible, using a cool bath or cold compresses. Don't give water to a heat stroke victim.

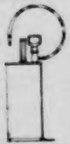
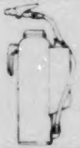
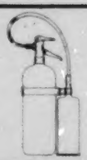
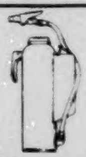
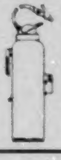
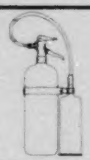
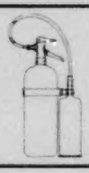
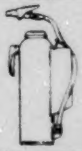
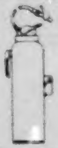
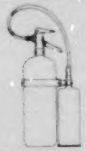
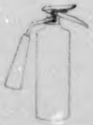
So when the temperatures begin to soar upward, take a few precautions to minimize your body's level of heat stress:

- Try to take frequent rest periods.
- Space heavier workloads or workouts throughout the day, rather than concentrating them in a few consecutive hours.
- Avoid heavy activity during the hottest part of the day.
- Drink plenty of water or other fluids.
- Wear loose, light clothing that reflects the sun's rays and allows sweat to evaporate. A hat will add further protection.

Coping with summer heat is just a matter of using common sense.

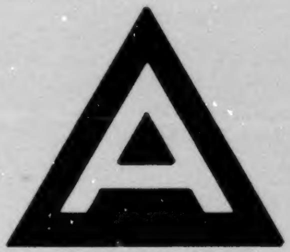
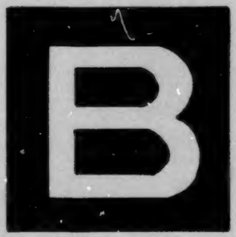
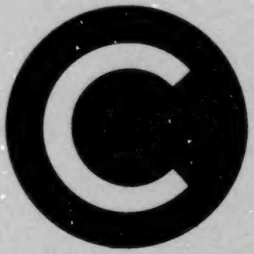
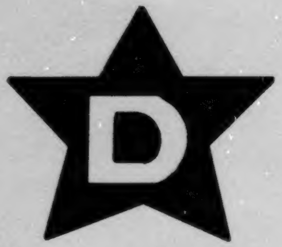
Used with permission of the National Safety Council, from *Safe Worker*.

Types of Fire Extinguishers

KIND OF FIRE		APPROVED TYPE OF EXTINGUISHER					
		MATCH UP PROPER EXTINGUISHER WITH CLASS OF FIRE SHOWN AT LEFT Important: Using the wrong type extinguisher for the fire may be dangerous					
DECIDE THE CLASS OF FIRE YOU ARE FIGHTING. . .	THEN CHECK THE COLUMNS TO THE RIGHT OF THAT CLASS	CARBON DIOXIDE Carbon Dioxide Gas Under Pressure	PUMP TANK Plain Water	MULTI-PURPOSE DRY CHEMICAL	ORDINARY DRY CHEMICAL	HALON	DRY POWDER
CLASS A FIRES A Use These Extinguishers ORDINARY COMBUSTIBLES ●Wood ●Paper ●Cloth, etc.							
CLASS B FIRES B Use These Extinguishers FLAMMABLE LIQUIDS, GREASE ●Gasoline ●Paints ●Oils, etc.							
CLASS C FIRES C Use These Extinguishers ELECTRICAL EQUIPMENT ●Motors ●Switches, etc.							
CLASS D FIRES D Use This Extinguisher COMBUSTIBLE METALS ●Iron ●Magnesium							

Adapted with permission of American Association for Vocational Instructional Materials, Athens, Georgia, from *Developing Shop Safety Skills* by Clinton O. Jacobs and J. Howard Turner, 1981.

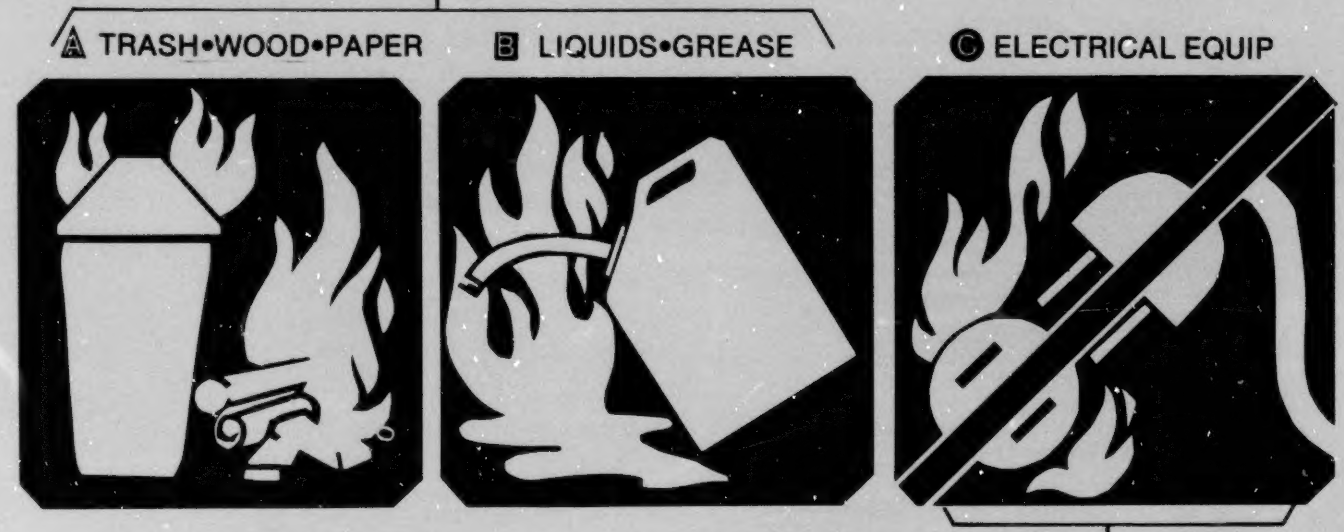
Standard Letter Symbols for Fire Extinguishers

GREEN	RED	BLUE	YELLOW
			
ORDINARY COMBUSTIBLES	FLAMMABLE LIQUIDS	ELECTRICAL EQUIPMENT	COMBUSTIBLE METALS

Distinctive letters, shapes, and colors mark extinguishers according to the classes of fires on which they should be used.

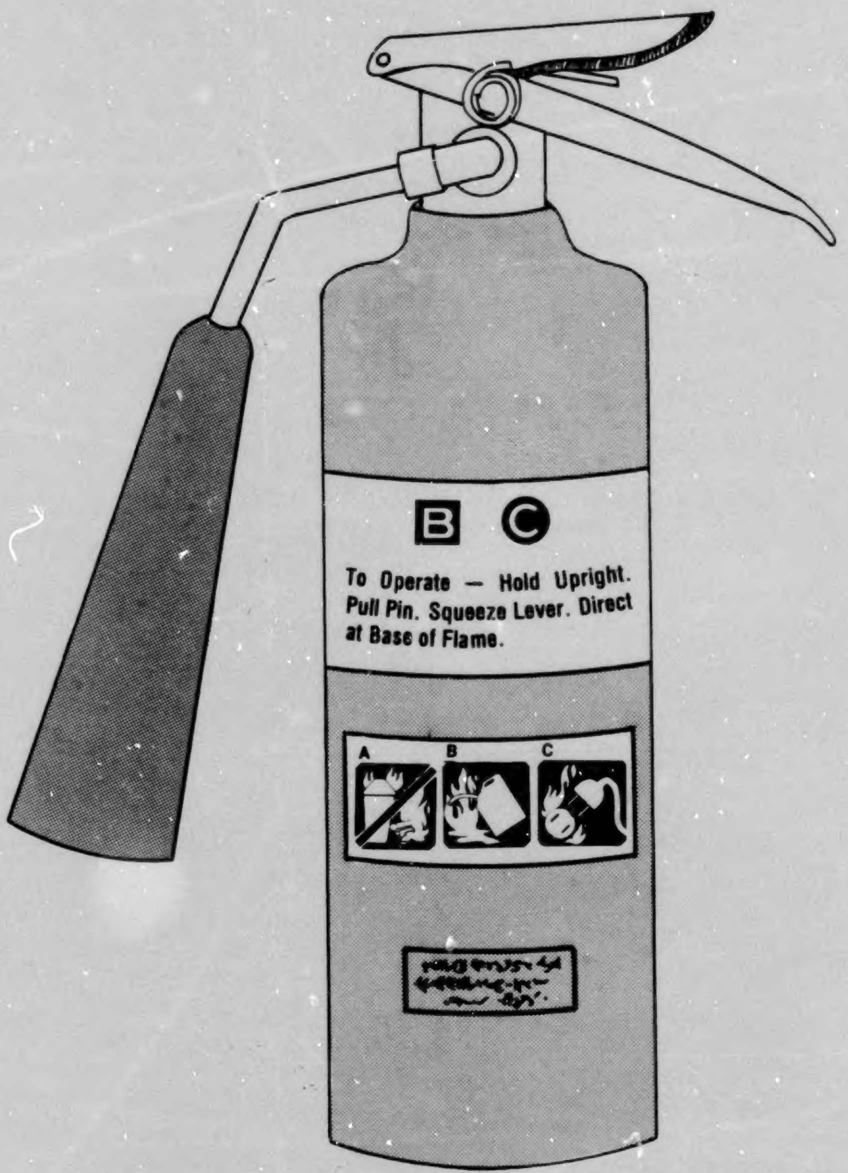
New Pictorial Symbols Used to Label Fire Extinguishers

Symbols with blue backgrounds indicate fire extinguisher can be used for class of fire portrayed.

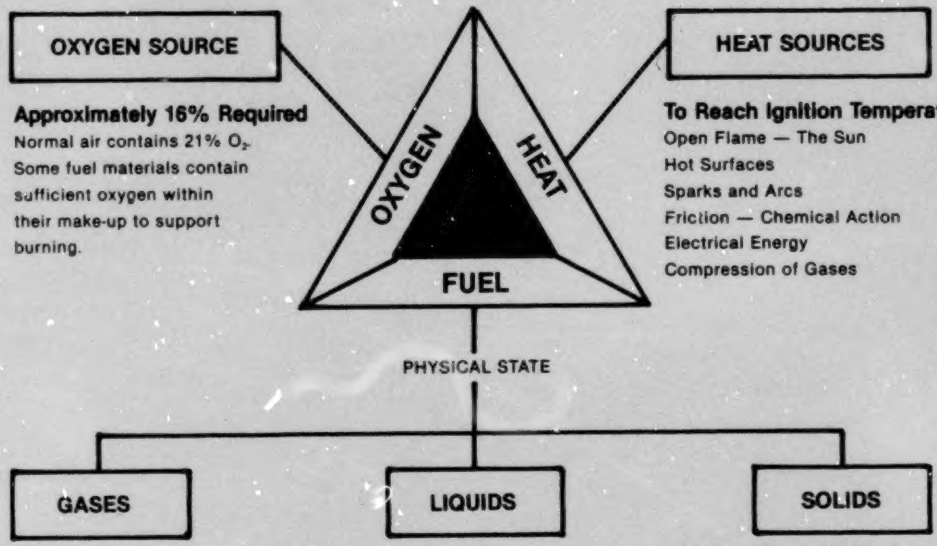

A TRASH•WOOD•PAPER
B LIQUIDS•GREASE
C ELECTRICAL EQUIP

Symbols with red line across a black background indicate fire extinguisher *cannot* be used for class of fire portrayed.

Fire Extinguisher Suitable for Class B and Class C Fires


B C
To Operate — Hold Upright. Pull Pin. Squeeze Lever. Direct at Base of Flame.
A
B
C

Fire Triangle



OXYGEN SOURCE

Approximately 16% Required

Normal air contains 21% O_2. Some fuel materials contain sufficient oxygen within their make-up to support burning.

HEAT SOURCES

To Reach Ignition Temperature

Open Flame — The Sun
Hot Surfaces
Sparks and Arcs
Friction — Chemical Action
Electrical Energy
Compression of Gases

GASES

Natural Gas
Propane
Butane
Hydrogen
Acetylene
Carbon Monoxide
Others

LIQUIDS

Gasoline
Kerosene
Turpentine
Alcohol
Cod Liver Oil
Paint
Varnish
Lacquer
Olive Oil
Others

SOLIDS

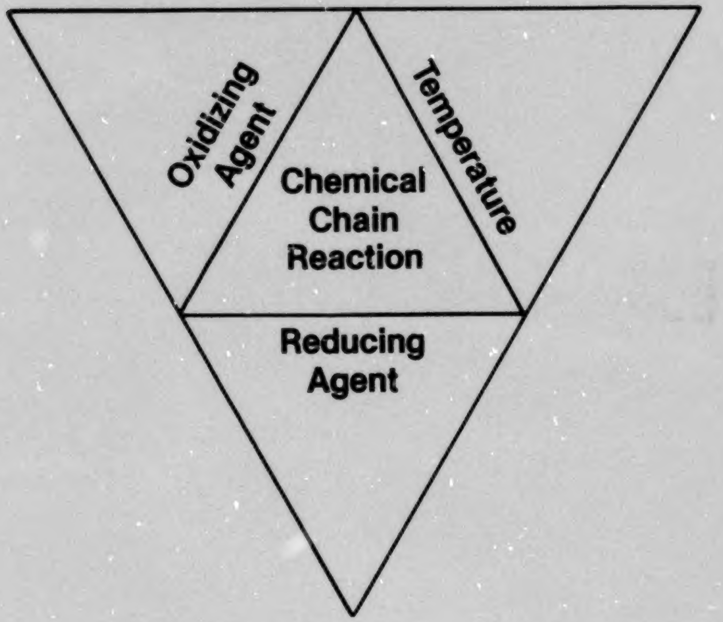
Bulky — Finely Divided — Dust

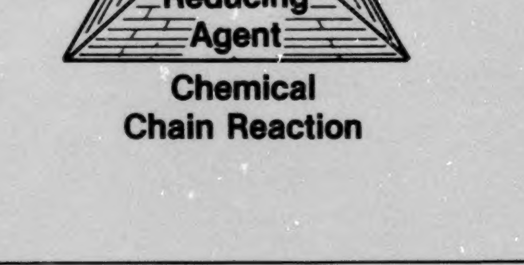
Coal
Wood
Paper
Cloth
Wax
Grease
Leather

Plastic
Sugar
Grain
Hay
Cork
Others

Used with permission of the Board of Regents, Oklahoma State University, Stillwater, Oklahoma, from *Essentials of Fire Fighting*, 2nd edition, Gene P. Carlson and William J. Vandevort, eds., 1983.

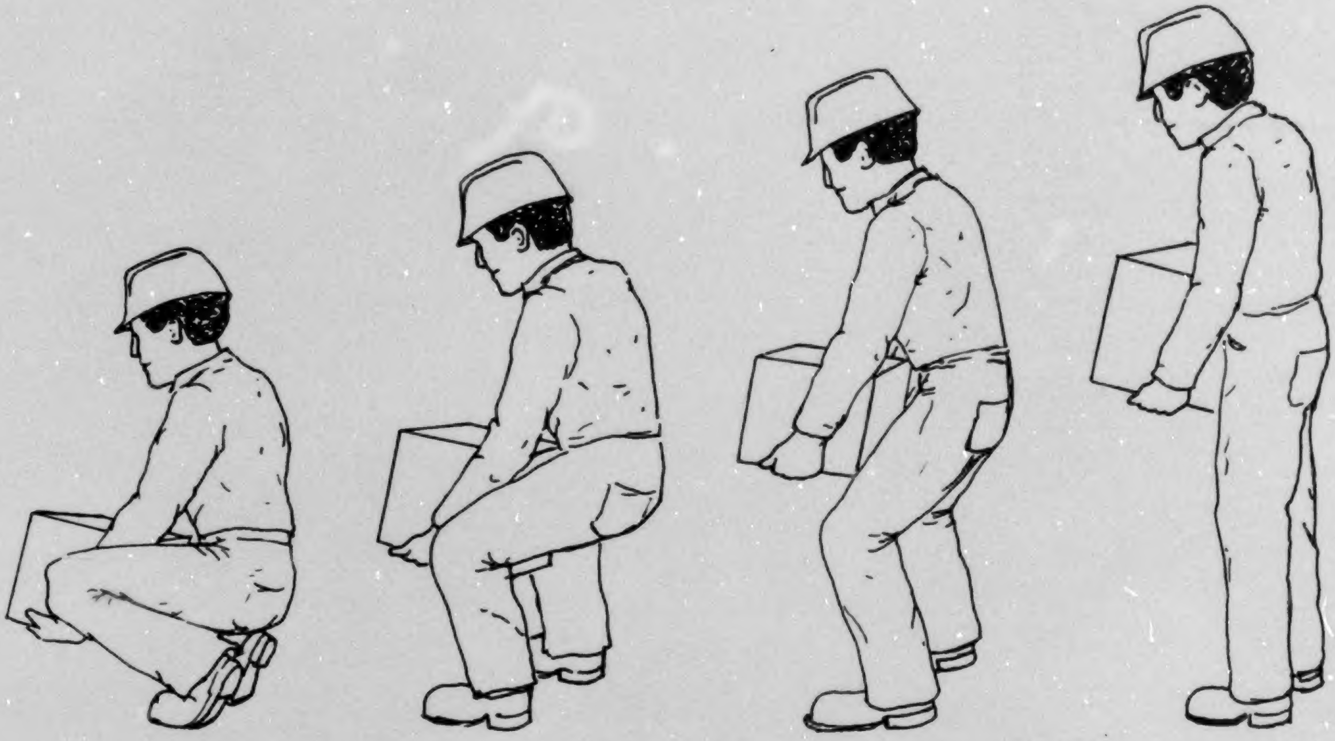
Fire Tetrahedron


Oxidizing Agent
Temperature
Chemical Chain Reaction
Reducing Agent


Oxidizing Agent
Temperature
Reducing Agent
Chemical Chain Reaction

Adapted with permission of the Board of Regents, Oklahoma State University, Stillwater, Oklahoma, from *Essentials of Fire Fighting*, 2nd edition, Gene P. Carlson and William J. Vandevort, eds., 1983.

Correct Way to Lift Heavy Objects

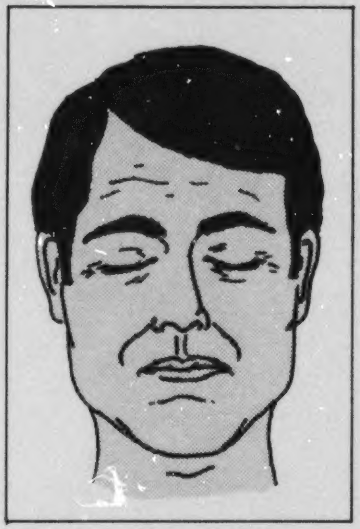


TM #7

FC - 245-A

Face and Skin Conditions in Heat Stroke and Heat Exhaustion

Heat Stroke

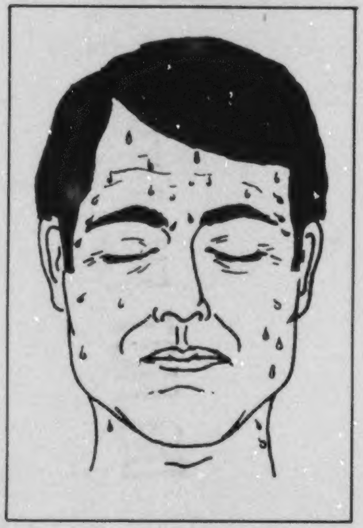


Skin Condition

Hot Red Dry

Cool body quickly.
Get immediate medical help.

Heat Exhaustion



Skin Condition

Clammy Pale Heavy Sweating

Get victim out of sun and heat, elevate feet, cool body, give sips of salt water.

SAFETY AND BASIC FIRST AID
UNIT V

INFORMATION SHEET

I. Terms and definitions

A. Safety — Freedom from danger, risk, or injury

B. First aid — Immediate, temporary care given to the victim of an accident or sudden illness until the services of a physician can be obtained

C. Accident — Any suddenly occurring, unintentional event that causes injury or property damage

D. Hazard — Source of danger

E. Carelessness — Negligence; failure to think before one acts, or failure to pay attention

F. Flammable — Capable of being easily ignited and burning with extreme rapidity

G. Explosive — Tending to blow up or burst violently and loudly

H. Combustible — Capable of bursting into flames

I. Extinguish — To put out a fire; to quench or smother

J. Pressurized — Stored under pressure greater than the pressure of the atmosphere

K. Resuscitation — Act of reviving a person by bringing the person back to full consciousness

L. Traumatic shock — Depressed condition of many of the body functions due to failure of enough blood to circulate through the body following serious injury

M. Tourniquet — Any device, such as a bandage and stick, used to compress a blood vessel to stop bleeding or to control blood flow

(NOTE: Tourniquets are used *only* for severe, life-threatening hemorrhage that cannot be controlled by any other means.)

N. Hemorrhage — Heavy loss of blood

O. Closed fracture — Broken bone beneath the skin with no open wound

INFORMATION SHEET

P. Open fracture — Broken bone associated with an open wound

EXAMPLES: Broken bone end tears through skin, machinery penetrates skin and breaks one or more bones

II. Job safety rules

A. General

1. Be familiar with location of fire-fighting and first-aid equipment
2. Be alert and conduct yourself in a manner that will ensure safe practices
3. Be conscious of others' safety
4. Report all accidents to the supervisor, regardless of nature or severity

B. Dress

1. Wear close-fitting clothing appropriate for activity being performed
2. Confine long hair before operating power equipment
3. Wear safety glasses, suitable hard hat, goggles, safety shoes, gloves, ear protection, and respiratory equipment when required

   (NOTE: When working on a site at which welding is being performed, never look at welding flash, arc, or reflection without welding goggles. Irreversible damage to the retina can occur.)
4. Remove rings and other jewelry when working
5. Do not carry sharp tools in pockets

C. Equipment and tools

1. Obey all safety rules, and observe limitations on equipment according to specifications and manufacturer's requirements
2. Keep all tools sharp and clean, in safe working order, and properly stored when not in use
3. Retain guards and safety devices on all equipment
4. Tag and report to the supervisor any defective tools, machines, or other equipment
5. Be sure to shut off all power equipment when finished with it, and do not leave equipment until it has stopped completely

INFORMATION SHEET

6. Operate equipment *only after* receiving instructions on how to operate it safely

7. Disconnect power from equipment before changing accessories and before performing service or maintenance on it

8. Use the correct tool for the job

9. Clean chips from saws, grinders, and other equipment with a brush, not with your hands or a rag; *do not* clean equipment while it is running

D. Work area

1. Arrange equipment to permit safety-efficient work practices and ease of cleaning

2. Store materials and supplies safely in their proper places

3. Store tools and accessories safely in cabinets, on racks, or in suitable storage areas

4. Keep work area clear of debris and other hazards

5. Always pull nails from wood before throwing it aside

6. Clean floors of obstructions and slippery substances; clean up spills immediately

7. Keep aisles, exits, and traffic areas free of materials and debris

8. Dispose of combustible materials properly

9. Keep sufficient brooms, brushes, waste containers, and other housekeeping equipment readily available

E. Flammable liquids

1. Carefully read labels on all flammable liquids, and use only in open, well-ventilated areas

   (NOTE: Be cautious of inhaling or igniting fumes from flammable liquids.)

2. Be sure that all flammable liquids are marked correctly for storage

3. Store all flammable liquids properly in approved safety containers

   (NOTE: Oily rags and flammable materials should be stored in metal containers with self-sealing lids.)

INFORMATION SHEET

4. Immediately change clothing soaked by flammable liquids

5. Use flammable liquids only for their intended purposes

   EXAMPLE: Never use gasoline as a cleaner.

6. Do not use flammable liquids near fire or flame

7. Always know location of appropriate fire extinguisher

8. Stop, drop, and roll if your hair or clothing catches fire; *never* run

F. Gasoline-powered equipment

1. Use caution to prevent contact with hot manifolds and hoses

2. Be sure that engine is out of gear before starting

3. Always keep appropriate fire extinguisher near when starting and operating gasoline-powered equipment

4. Do not pour gasoline into carburetor or cylinder head when starting engine

5. Never pour gasoline into fuel tank when engine is hot or when engine is running

6. Do not operate equipment that is leaking gasoline

7. Stop, drop, and roll if your hair or clothing catches fire; *never* run

III. Colors and applications of the safety color code

A. Federal safety red

1. Designates danger

2. Identifies fire-protection equipment and its location

3. Identifies portable containers of flammable liquids

4. Identifies emergency stop bars, stop buttons, and emergency electrical stop switches on machinery

B. Federal safety yellow

1. Designates caution and marks physical hazards

   EXAMPLES: Low beams, protruding extensions, steps

INFORMATION SHEET

   2. Designates waste containers for explosive or combustible materials

   3. Designates caution against starting, using, or moving equipment while it is under repair, and against the use of defective equipment

   4. Identifies the starting point or power source of machinery

C. Federal safety orange

   1. Designates dangerous parts of equipment that may cut, crush, shock, or otherwise injure

   2. Designates safety starter buttons and parts of equipment that may cause electrical shock

   3. Designates exposed parts (edges only) of pulleys, gears, rollers, cutting devices, and power jaws

D. Federal safety purple (or black or magenta on safety yellow) — Designates radiation hazards

E. Federal safety blue

   1. Designates caution against and provides information about machines or equipment out of order or under repair

   2. Identifies out-of-order signs on equipment

F. Federal safety green

   1. Designates location of safety equipment other than fire-fighting equipment

   2. Designates location of first-aid equipment

G. Federal safety black and white (used individually or in combination)

   1. Designates traffic flow

   2. Designates items for housekeeping purposes

   3. Designates storage areas

IV. Descriptions of classes of fires

(NOTE: Fire extinguishers are labeled according to the class or classes of fires on which they may be used, the class letters prominently displayed in distinctive shapes and colors. Most new extinguishers also contain pictorial labels depicting the class or classes of fires on which the extinguisher may and may *not* be used.)

INFORMATION SHEET

A. Class A — Fires that occur in ordinary combustible materials such as wood, rags, rubber, and plastics

B. Class B — Fires that occur with flammable liquids such as gasoline, oil, grease, paint, and thinners

C. Class C — Fires that occur in or near electrical equipment such as motors, switchboards, and electrical wiring

D. Class D — Fires that occur with combustible metals such as iron, magnesium, sodium, and potassium

V. Why knowledge of first aid is important

A. May mean the difference between life and death

B. May mean the difference between temporary and permanent disability

C. May mean the difference between rapid recovery and long hospitalization

D. Prepares one for what to do and what not to do in an emergency

E. Promotes safety awareness

VI. First-aid actions to follow in an emergency

(NOTE: When you give first aid, you deal with the victim's physical condition, the victim's emotional state, and the whole accident situation. First aid also includes care needed later if medical help is delayed or is not available. Urgent care is first aid given in life-threatening situations. These situations include stopped breathing, heart attack and stroke, heavy bleeding, poisoning, and shock. The actions listed below are from the Red Cross book *Standard First Aid and Personal Safety* and are given in the order in which you might take them in an emergency.)

A. Rescue victim and yourself

B. Restore or maintain breathing and heartbeat

C. Control heavy bleeding

D. Treat for poisoning

E. Prevent shock

F. Examine victim carefully

G. Seek medical help

H. Keep checking and assisting victim until medical help is obtained

INFORMATION SHEET

VII. Carpentry-related injuries that require the administration of first aid

A. Bleeding

EXAMPLES: Cuts, punctures, scrapes, severed fingers or limbs

B. Burns

C. Loss of consciousness

EXAMPLES: Blow to the head, being overcome by fumes, heat-related distress

D. Respiratory failure/cardiac arrest

EXAMPLES: Obstruction of the air passages, inhalation of toxic gases, explosion, electrocution, circulatory collapse (shock), heart attack, compression of the chest (caused, for example, by a heavy beam or a piece of equipment falling on victim)

E. Eye injuries

EXAMPLES: Foreign objects or substances, welding burns, cuts, punctures

F. Muscle and ligament strain or sprain

(NOTE: Muscle injuries, especially to the back, usually result from improper lifting.)

G. Broken bones

(NOTE: Injuries to the skeletal system are common in all types of major accidents.)

VIII. Symptoms of traumatic shock

(NOTE: Injury-related or traumatic shock can occur to some degree with any injury. It can threaten life even though the victim's injuries may not otherwise be fatal. The three objectives in treating shock are 1] to improve circulation of the blood, 2] to ensure an adequate supply of oxygen, and 3] to maintain normal body temperature.)

A. Early stages

1. Pale or bluish skin that is cold to the touch
2. Moist, clammy skin if perspiration has occurred
3. Weakness

INFORMATION SHEET

4. Rapid pulse (over 100 beats/minute), often too faint to be felt in wrist but perceptible in carotid artery at side of neck or femoral artery at groin

5. Increased rate of breathing that may be shallow or possibly deep and irregular

6. Restlessness, anxiousness, severe thirst if victim is in shock from hemorrhage

7. Vomiting or nausea

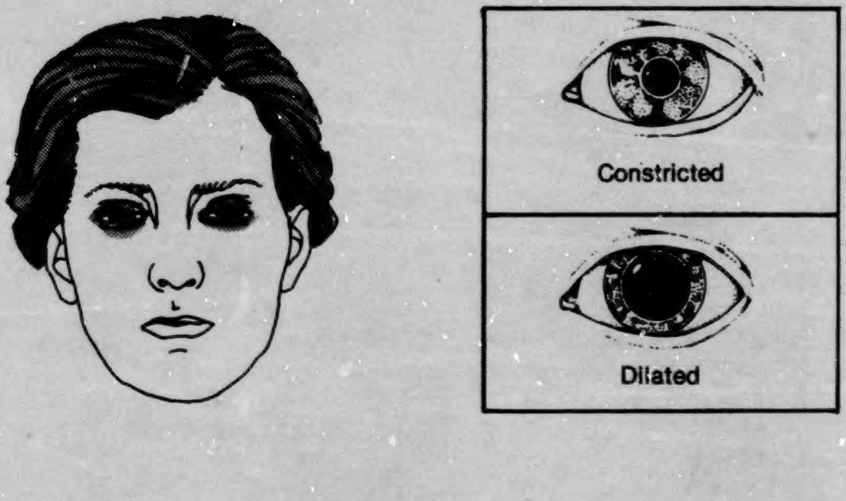
B. Late stages

1. Apathy and relative lack of responsiveness

2. Sunken eyes with vacant expression and widely dilated pupils (Figure 1)

EXAMPLE:

FIGURE 1



3. Mottled appearance to skin, indicating that victim's blood pressure has fallen to a very low level

4. Loss of consciousness, low body temperature, and death if untreated

INFORMATION SHEET

IX. Measures to take for prevention of heat stroke, heat cramps, and heat exhaustion

A. Drink plenty of fluids

B. Increase salt intake

C. Do not overexert

D. Wear lightweight clothing that allows sweat to evaporate

E. Keep head covered and face shaded

F. Take frequent short work breaks

G. Rest in the shade or an air-conditioned room whenever possible

X. Symptoms of heat stroke and heat exhaustion

A. Heat stroke — Flushed, hot, dry skin and high body temperature

(NOTE: Heat stroke is an immediate, life-threatening emergency urgently requiring medical attention. The main symptoms of heat stroke are listed above, but other symptoms may include dizziness, nausea, headache, rapid pulse, offensive body odor, and unconsciousness.)

B. Heat exhaustion — Pale, cool, clammy skin and normal body temperature

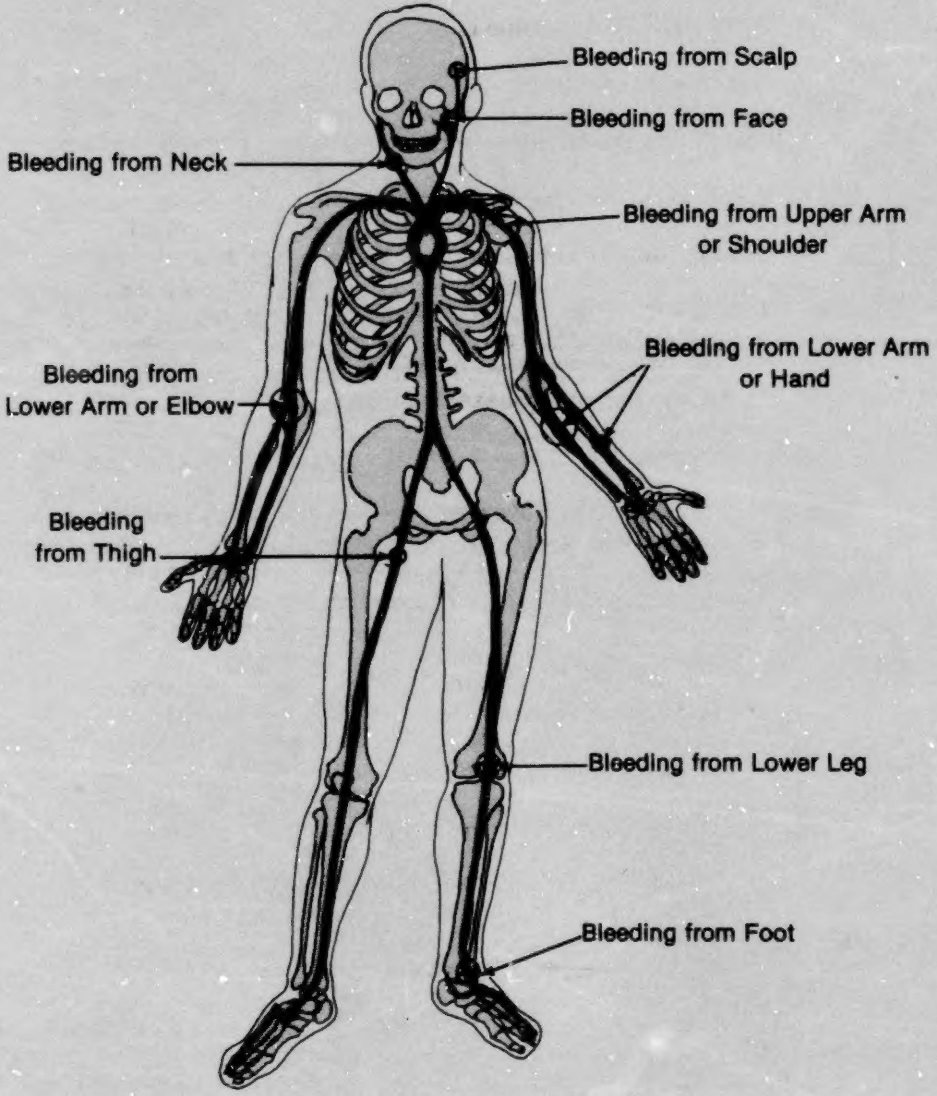
(NOTE: Heat exhaustion is a much less dangerous condition than heat stroke. Symptoms, in addition to the main ones listed above, may include heavy sweating, extreme tiredness or weakness, headache, vomiting, and fainting. Heat cramps in the abdomen or legs may accompany or precede heat exhaustion.)

INFORMATION SHEET

XI. Pressure points to use to control bleeding from various areas of the body (Figure 2)

(NOTE: Because direct pressure stops circulation only at the wound, it is better to control bleeding through the use of direct pressure than it is to use a pressure point or a tourniquet. Do not use a pressure point for an arm or leg wound unless direct pressure and elevation do not stop the bleeding. Always release the pressure point gradually when bleeding has been brought under control.)

FIGURE 2


Bleeding from Scalp
Bleeding from Face
Bleeding from Neck
Bleeding from Upper Arm or Shoulder
Bleeding from Lower Arm or Hand
Bleeding from Lower Arm or Elbow
Bleeding from Thigh
Bleeding from Lower Leg
Bleeding from Foot

INFORMATION SHEET

XII. Symptoms of first-, second-, and third-degree burns

A. First-degree burns

(NOTE: First-degree burns can be caused by sunburn, light contact with hot objects, accidentally touching a hot engine component, or contact with hot water or scalding steam from a radiator.)

1. Redness or discoloration
2. Mild swelling and pain
3. Rapid healing

B. Second-degree burns

(NOTE: Second-degree burns can be caused by contact with hot liquids [hot tar or asphalt], mild electrical burns, or by a deep sunburn.)

1. Pain greater than that caused by first-degree burn
2. Damage extending into first layer of tissue
3. Mottled or red areas
4. Blistering
5. Considerable swelling
6. Wet appearance of burned area due to loss of plasma

C. Third-degree burns

(NOTE: Third-degree burns can be caused by flame, ignited clothing, hot objects, acid, electricity, or immersion in hot water.)

1. Deep tissue destruction
2. Less pain because of nerve destruction

   (NOTE: Pain may be greatly diminished because nerve tissue has been burned.)

3. Charred or white appearance of burned area

XIII. Guidelines for administering first aid to a victim with an eye injury

(NOTE: Extreme care should be taken in administering first aid for injuries of the eye. The eye is very sensitive and can easily be damaged further if the correct first-aid methods are not carried out.)

INFORMATION SHEET

A. Do not let victim rub the eye

B. Do not attempt to remove a foreign object by using any sharp object

EXAMPLES: Tweezers, toothpick

C. Keep victim flat on back if injury is caused by a penetrating object or a severe blow

(NOTE: For cuts and punctures of the eye or eyelid, get medical help at once. *Do not* wash out eye with water. *Do not* try to remove an object stuck in the eye.)

D. Cover eye with a clean dressing if foreign object is lodged in eye and cannot be removed easily by flushing with water or by using a clean cloth

(NOTE: Flushing of eye should be done with extreme care to avoid further injury, infection, or contamination to the other eye.)

E. Immediately flood chemical substances in eye with water

XIV. Signs and symptoms of fractures

(NOTE: An accurate diagnosis of a fracture can be made only by a physician with the assistance of an x-ray examination. The first-aid worker should *suspect* that a bone is broken. Even if there is doubt, if any one of the signs or symptoms is present, the first-aid worker should carry out first-aid measures for a fracture.)

A. Victim's account of accident

EXAMPLES: May have heard or felt a bone snap
May indicate location of pain and tenderness and difficulty moving injured part
May report grating sensation of broken bones rubbing together
May report abnormal or false movement in suspect area

B. Differences in shape and length of corresponding bones on the two sides of body

C. Obvious deformities

D. Swelling

E. Discoloration

F. Pain or tenderness to touch

INFORMATION SHEET

XV. Guidelines for administering first aid to a victim with a suspected fracture

(NOTE: The objectives for administering first aid for fractures include 1] providing necessary first-aid care, 2] preventing broken bone ends and adjacent joints from moving, and 3] giving care for shock.)

A. Prevent motion of injured parts and adjacent joints

B. When an injured person obviously requires hospitalization and an ambulance is on the way, do not attempt to move victim unless there is a life-threatening emergency

EXAMPLES: Danger of fire, carbon monoxide poisoning, explosion

C. Give priority to open fractures over closed fractures unless associated injuries dictate otherwise

D. Never test fracture by having the victim move the part or try to walk on a possibly broken leg

E. Never attempt to set or reduce a fracture or try to push a protruding bone end back in place

F. If possible, take time to tie victim's injured leg to uninjured one, or to bind injured arm to chest or side

G. Do not allow victim to move the head (or do not move it yourself) when there is a possible neck or spine fracture

H. Lift and move an unconscious victim as though the injury is to the neck or spine—provide rigid support for victim's back and head

I. After providing urgent care, treat to prevent shock

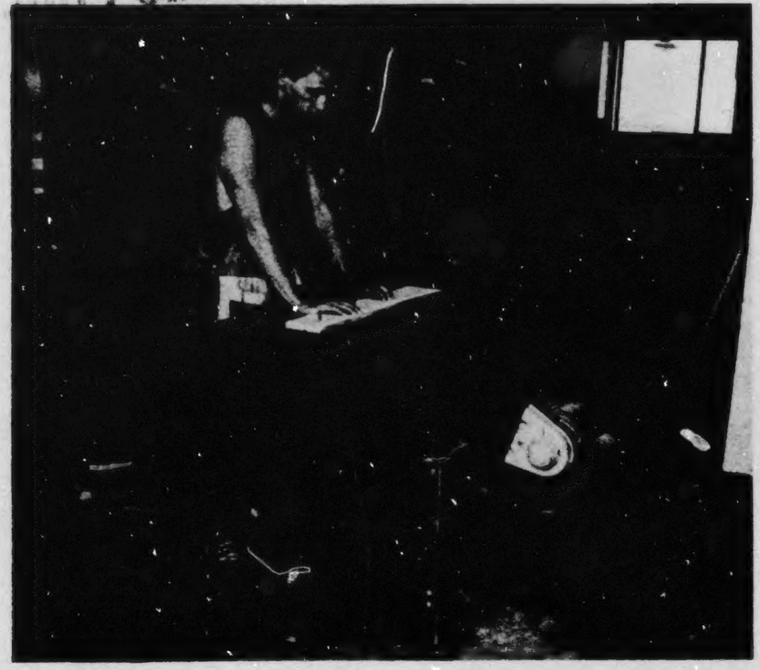
SAFETY AND BASIC FIRST AID
UNIT V

ASSIGNMENT SHEET #1 — IDENTIFY JOB-SITE AND SHOP SAFETY VIOLATIONS

NAME ______________________________ SCORE ______________

A skilled carpenter is constantly aware of threats to his or her own safety and to the safety of others in the work area. The carpentry profession requires the use of many dangerous tools, and requires work in areas where an accident is possible with even momentary carelessness. In order to prevent serious injury or even death, safe carpenters must always be on the lookout for dangerous situations in their work and in the work of those around them.

Study the following photograph and note any hazardous situations that exist. Write your list of dangerous conditions or practices on the blanks below the photo.



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SAFETY AND BASIC FIRST AID
UNIT V

ASSIGNMENT SHEET #2 — MATCH FIRE-EXTINGUISHER SYMBOLS TO GIVEN TYPES OF FIRES

NAME ____________________ SCORE ____________

One of the dangers of working in the carpentry trade is that the worker is exposed to potential fire hazards. In fact, on most job sites, all four classes of fire are possible. Scrap lumber, rags, packaging, insulation, and other materials present the constant threat of a Class A fire. Class B fires can result from the wide use of gasoline and other flammable substances such as adhesives, paints and thinners, oils, and lubricants. Electrical wiring within the structure, the use of electrical tools and equipment, and the need for exposed outlets and extension cords can create numerous Class C fire hazards. Even Class D metal fires are a possibility because of welding, cutting, and other operations that produce high temperatures. Thus, it is critical that carpenters be able to determine quickly the source of a fire in order to select the correct fire extinguisher to fight it.

In this assignment, you are presented with descriptions of several fires and are asked to choose the correct extinguisher to use on each fire. List only the minimum type of acceptable fire extinguisher. For example, if a fire is a Class A fire, list only the A type extinguisher, even though you could use an A, AB, or ABC extinguisher on that particular fire.

Match the following fire-extinguisher symbols to the given types of fires. Write the correct numbers in the blanks.

_____A. Fire in the scrap lumber pile

_____B. Flames coming from the motor of a radial-arm saw

_____C. Metal studs burning near a reinforcement weld

_____D. Fire caused by cigarette ashes dropping into adhesive spread over a plywood counter top

_____E. Fire near the carburetor of a gasoline-powered electrical generator

_____F. Smoke coming from a barrel of oily rags

_____G. Smoldering insulation around a shorted electrical outlet

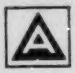
_____H. Wood shavings ignited by sparks from a circular saw

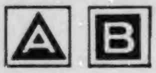
_____I. Electric spray painter ignites

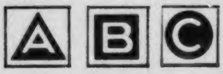
_____J. Can of paint thinner spills, and the thinner bursts into flames when someone drops a lighted cigarette in it

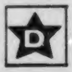
_____K. Space heater being used for winter finish work ignites paneling

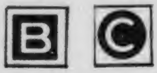
_____L. Can of paint thinner explodes into flame, igniting wall containing exposed electrical outlets

1. 

2. 

3. 

4. 

5. 

SAFETY AND BASIC FIRST AID
UNIT V

ASSIGNMENT SHEET #3 — ANALYZE CASE STUDIES TO DETERMINE CORRECT FIRST-AID TREATMENTS

NAME ______________________________ SCORE ______________

Quick and effective use of first-aid procedures can save your life or the lives of your co-workers. Even in situations that are not life-threatening, first aid can reduce the seriousness of an injury or prevent it from becoming life-threatening. The first step in any emergency situation is to determine the nature and extent of the injuries so that you can determine the proper treatment.

Read the situations described below and decide what kind of treatment is required. State the suspected type of injury based on the description, and then outline the basic emergency first-aid steps you would take and the order in which you would take them. Be specific enough to show that you understand the problem and the basic treatment.

A. A co-worker has shot a staple from a pneumatic stapler through his boot and into his foot. The staple comes out easily, and there is minimal bleeding. However, a few minutes later, he complains of feeling queasy. You notice that he is pale and that his skin feels cold and clammy. After a moment, he says that he feels weak and wants to rest. What is the problem and how should it be treated?

Problem: ______________________________

Treatment: ______________________________

____

____

____

____

____

B. One of the painters was spraying near an open flame of a gas water heater. The spray ignited in a flash fire. The painter has burns over his face, hands, and forearms. He is experiencing intense pain when you arrive. His hands are swollen and covered with blisters. They appear to be wet, almost waxy. His eyebrows are burned away, and his face looks puffy. It is covered with scattered blisters and dark red patches. What kind of burn does he have, and how do you treat it?

Problem: ______________________________

Treatment: ______________________________

____

ASSIGNMENT SHEET #3

C. A carpenter working near you has run her hand into a table-saw blade. Blood is gushing from the wound where the little finger has been severed and from the gash across her palm. When you wipe away the blood, streaks of white from tendons or bones show for a moment and then immediately disappear in the flow of blood. What actions should you take?

Treatment: ____________________

D. One of your co-workers was plugging a circular saw into a gang outlet lying on the slab of a new house when he screamed. There was a popping sound and a puff of smoke. The co-worker fell over and lay motionless on the floor. You turn off the electricity at the fuse box, and rush to the victim. On checking him, you find that his hand is swollen, mottled red, and smoke-scorched. Additionally, you notice that his lips and fingers are a bluish color. You check to see if he is breathing and find no sign of breath, though there is a weak pulse. What is the problem? What treatment is required?

Problem: ____________________

Treatment: ____________________

ASSIGNMENT SHEET #3

E. While opening a can of adhesive, a tile setter splatters the material into her eyes when the lid flies off suddenly. She grabs her eyes and begins screaming, "It burns! It burns!" What should you do?

Treatment:

F. While laying shingles on a hot August day, one of your co-workers begins to complain of being dizzy. You notice that he is sweating heavily and looks pale. Suddenly, he straightens out his left leg and begins rubbing the calf and thigh. He pulls up his pants leg, and you can see the muscles in his leg jerking spasmodically. What is the problem? What treatment should you provide?

Problem:

Treatment:

G. One of the carpenters on your job was starting a portable, gasoline-powered generator when there was a loud explosion. You look up to see her covered in flames. She begins running toward you, screaming. You knock her down and roll her on the ground to smother the flames. The generator continues to burn, but you have extinguished the flames on the victim's clothing. She is unconscious but breathing. Her pulse is rapid but weak. Her clothing is burned badly. Her legs are covered with ashy white burns surrounded by dark brown and black areas. Charred cloth from her pants is embedded in the burns. There is considerable blistering on her stomach, face, and hands. What is the problem? How should you care for this accident victim?

Problem:

Treatment:

ASSIGNMENT SHEET #3

H. You and a co-worker are working at a remote building site 30 miles from the nearest medical help. Your co-worker, who is carrying a cement block, slips and falls. The cement block flies out of his hands and lands on his lower leg. Upon questioning him and examining his leg, you discover that his lower leg is bent at an odd angle, and that there is discoloration, swelling, and considerable pain and tenderness at the injury site. What is the problem, and how would you treat it?

Problem:

Treatment:

SAFETY AND BASIC FIRST AID
UNIT V

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

A. Student using table saw with blade guard removed
B. Student using table saw without guide (fence or miter gauge)
C. Student not wearing eye protection
D. Student standing directly behind saw blade
E. Student wearing torn overalls (they may catch on something and cause student to lose balance)
F. Student sawing board with nails in it
G. Electric cords bunched up on floor
H. Power hand saw lying on floor

Assignment Sheet #2

A. 1
B. 3
C. 4
D. 2
E. 2
F. 2
G. 3
H. 1
I. 5
J. 2
K. 1
L. 5

Assignment Sheet #3

A. *Problem*: Traumatic shock
Treatment: Treat for shock

B. *Problem*: Second-degree burn
Treatment:
   1. Prevent shock
   2. Examine victim carefully
   3. Treat for second-degree burns
   4. Seek medical help
   5. Keep checking and assisting until medical help is obtained

C. *Treatment*:
   1. Control heavy bleeding by direct pressure
   2. Prevent shock
   3. Examine victim carefully
   4. After providing urgent care, transport victim and severed finger to hospital
   5. Continue checking and assisting until medical help is reached

ANSWERS TO ASSIGNMENT SHEETS

D. *Problem*: Respiratory failure and electrical burns caused by electrical shock
Treatment:
1. Restore breathing
2. Prevent shock
3. Examine victim carefully
4. Treat electrical burn on hand just as you would treat a second-degree heat burn
5. Seek medical help
6. Keep checking and assisting until medical help is obtained

E. *Treatment*:
1. Do not let victim rub eyes
2. Immediately flood eyes with water from a tap, drinking fountain, or hose and continue flushing for fifteen minutes; then cover eyes with clean dressing
3. Prevent shock
4. Seek medical help
5. Keep checking and assisting until medical help is obtained

F. *Problem*: Heat cramps (probably a signal of oncoming heat exhaustion)
Treatment:
1. Rescue co-worker by helping him off roof and out of sun, preferably to an air-conditioned room
2. Treat for heat cramps by applying firm pressure and warm, wet towels to cramped area, and by giving sips of salt water
3. Advise co-worker not to go back into the sun for a few days

G. *Problem*: Loss of consciousness due to traumatic shock and second- and third-degree burns over a considerable portion of body
Treatment:
1. Call for assistance, directing someone to extinguish the generator fire, and directing someone else to call for an ambulance
2. Treat to prevent shock
3. Treat blistered areas of stomach, face, and hands for second-degree burns; cover eyes with a clean, dry cloth
4. Treat burns on legs as for third-degree burns; do not remove the charred pieces of cloth from burns
5. Keep checking and assisting until medical help arrives

H. *Problem*: Suspected fracture
Treatment:
1. Examine victim carefully
2. Treat to prevent shock
3. Prevent motion of injured leg and adjacent joints by splinting leg
4. Seek medical help (in this case, you will have to transport the victim to the hospital, taking care not to move the injured leg)

SAFETY AND BASIC FIRST AID
UNIT V

JOB SHEET #1 — PERFORM FIRST-AID TREATMENT FOR SIMULATED ACCIDENT VICTIMS

I. Equipment and materials

- A. Resuscitation doll

  (NOTE: Never practice mouth-to-mouth resuscitation on a breathing person.)

- B. Clean dressings (prepared gauze, clean handkerchiefs, clean articles of clothing)
- C. Blankets
- D. Water and basin
- E. Rubbing alcohol
- F. Salt
- G. Cup or glass
- H. Sterile dressings (gauze pads and cotton)
- I. Splint material
- J. Strips of material for securing splints
- K. Towels

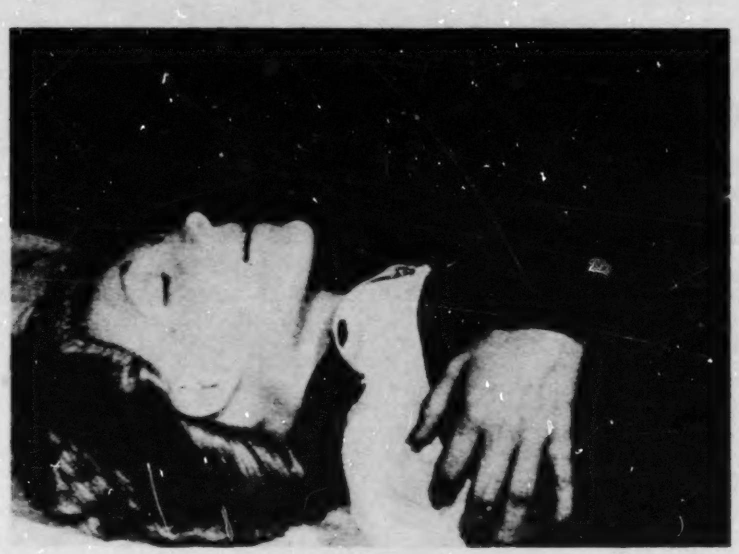
II. Procedure for victim of respiratory failure

- A. Check for breathing
  - 1. Look and listen
  - 2. Check pulse on side of neck
- B. Clear victim's air passage
  - 1. Place victim flat on back (See Figure 3)

    (NOTE: If it is necessary to roll victim over, try to roll the victim over all at once, keeping back and neck straight to avoid making any possible spinal injury worse.)

JOB SHEET #1

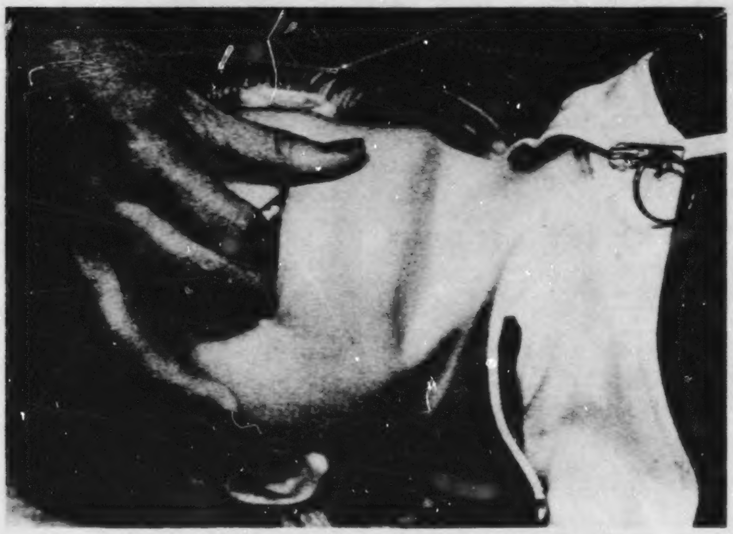
FIGURE 3



2. Remove all foreign objects from victim's mouth and throat (Figure 4)

(NOTE: If there is an obstruction, carefully turn victim on side, tilt victim's head down, and clean mouth out with your fingers. When obstruction is removed, carefully position victim onto back again.)

FIGURE 4

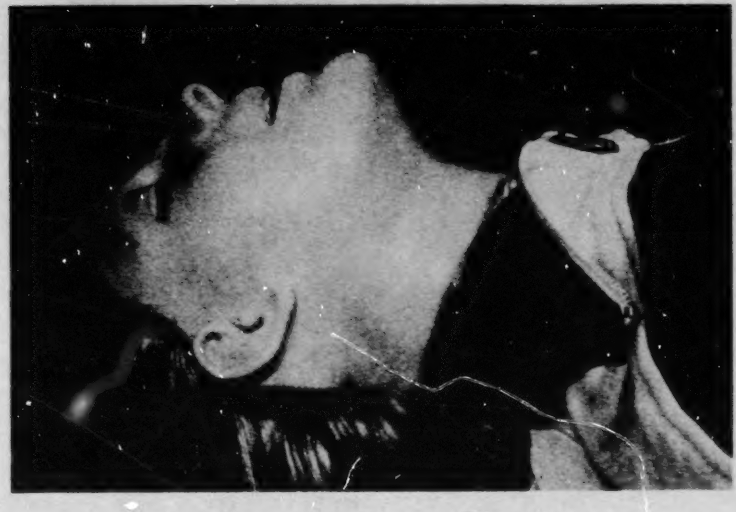


JOB SHEET #1

3. Kneel at victim's side and lift up under the neck, tilting crown of head backwards (Figure 5)

   (NOTE: If possible, place rolled piece of clothing under the victim's shoulders; this will help to secure the backward tilt of head.)

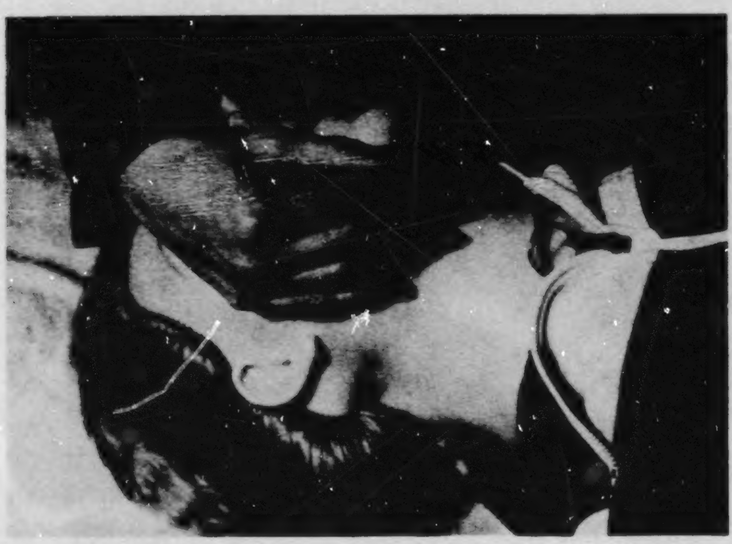
FIGURE 5



4. Pull the lower jaw so that the chin points straight up (Figure 6)

   (NOTE: This will pull the tongue forward and open the air passage.)

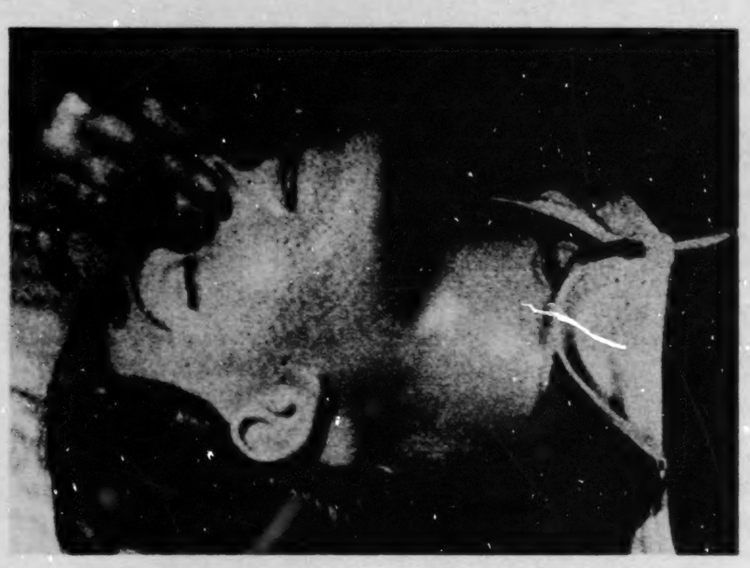
FIGURE 6



JOB SHEET #1

C. Pinch the nostrils shut while still lifting up under victim's neck (Figure 7)

FIGURE 7

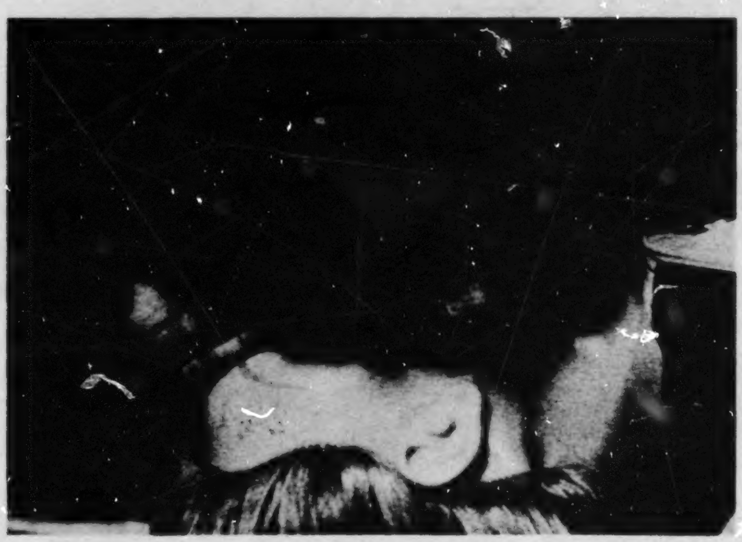


D. Inhale deeply, and while making an airtight seal with your mouth over the victim's mouth, breathe into victim's mouth until chest rises (Figure 8)

CAUTION

Keep victim's chin extended at all times.

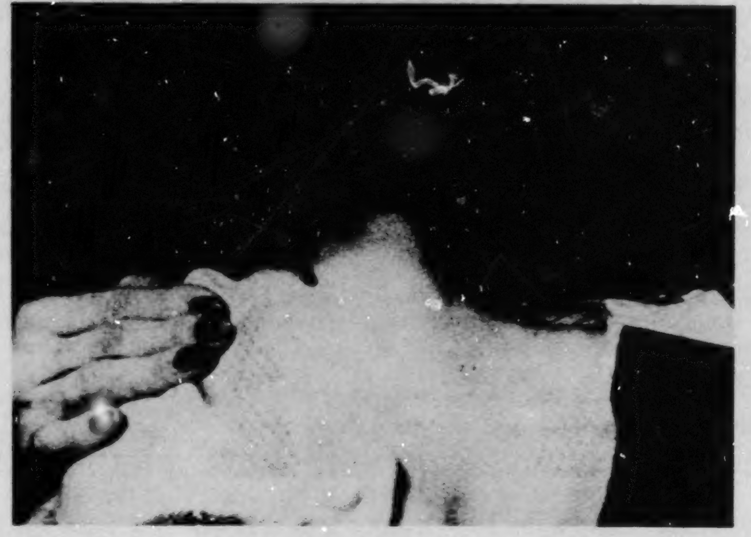
FIGURE 8



JOB SHEET #1

E. Remove your mouth from victim's mouth and listen for return flow of air (Figure 9)

FIGURE 9



F. Continue breathing/listening procedure at rate of twelve breaths per minute for an adult, or one breath per five seconds for a child

G. Repeat steps C through F until victim is breathing on his or her own or until medical help takes over treatment

III. Procedure for bleeding victim

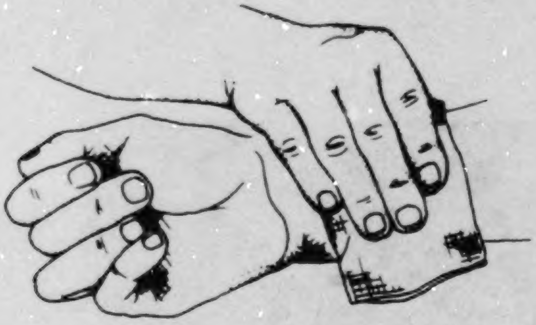
> **CAUTION**
>
> Never remove a penetrating object from a wound as this could be fatal for the victim. Apply dressing around the object as best you can. Direct pressure and elevation will stop bleeding from most wounds.

A. Apply a thick dressing (prepared gauze, clean handkerchiefs, clean articles of clothing) directly over wound, and press *firmly* with hand (See Figure 10)

(NOTE: In some cases the bare hand has to be used until a suitable dressing can be found.)

JOB SHEET #1

FIGURE 10



B. Elevate wound when you apply direct pressure if it does not cause pain and you do not suspect broken bones

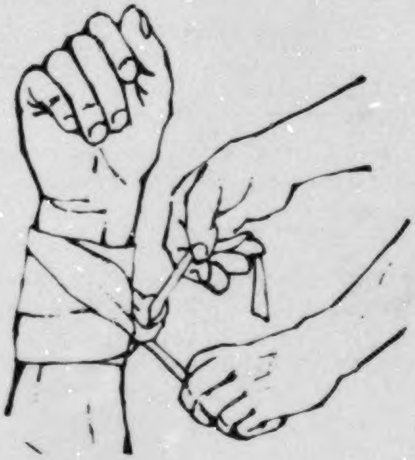
C. Check frequently to see if bleeding has stopped or slowed

CAUTION

Do not disturb blood clots after they have formed. If blood soaks through dressing, do not remove dressing, but add more layers.

D. If bleeding is still active, apply a pressure bandage by holding the dressing in place with one hand, wrapping bandage directly over and around wound, and tying knot over wound (Figure 11)

FIGURE 11



JOB SHEET #1

E. If bleeding continues, keep using direct pressure (and elevation when suitable), but also use a pressure point

(NOTE: Do not use a pressure point for an arm or leg wound unless direct pressure and elevation do not stop the bleeding.)

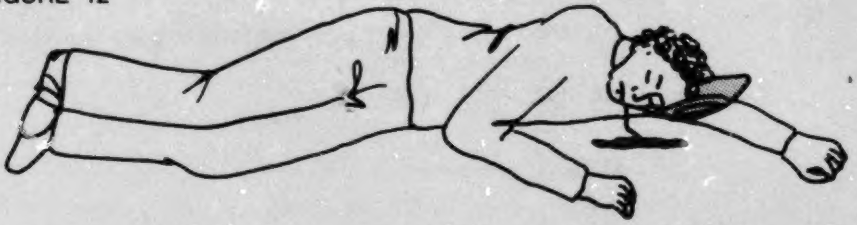
F. When bleeding is under control, gradually release the pressure point

G. Treat victim to prevent shock

(NOTE: A victim may suffer shock and loss of consciousness from loss of blood. Because it is possible to bleed to death in a very short period of time, bleeding should be given urgent care, and then the victim should be treated for shock.)

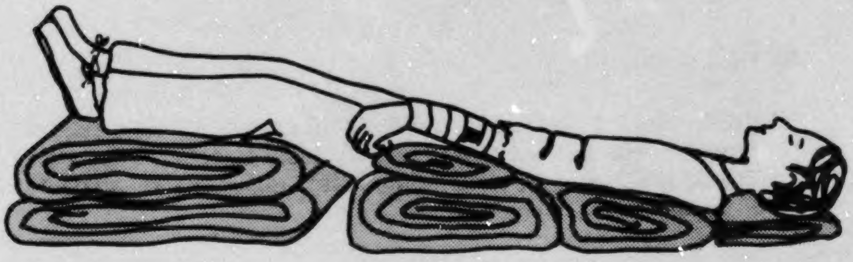
1. Keep victim lying down
2. If victim is bleeding from the mouth, place victim on one side so that blood will drain from mouth (Figure 12)

FIGURE 12



3. If victim feels faint, raise feet and legs—but only if moving the legs does not cause injury or pain (Figure 13)

FIGURE 13



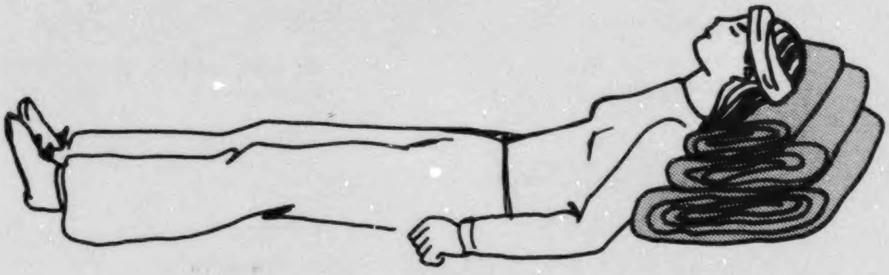
JOB SHEET #1

4. If victim is having difficulty breathing, raise the head *and* shoulders to maintain adequate supply of oxygen (Figure 14)

CAUTION

Raising only the head may bend the neck and block the airway. Do not raise head and shoulders if you suspect a neck or back injury.

FIGURE 14



5. Cover victim to prevent loss of body heat and to stabilize blood circulation

6. Use good judgment in giving fluids

CAUTION

Give only a few sips of fluid at a time, and give no alcoholic beverages. If there is danger of choking, vomiting, or respiratory failure, give no fluids.

H. Get medical help as soon as possible

IV. Procedure for victim of heat distress

A. Heat stroke

(NOTE: Heat stroke is always a life-threatening situation. In heat stroke, the victim's temperature control system that causes sweating stops working correctly. The body temperature rises so high that brain damage and death will result if the victim is not cooled quickly.)

1. Move victim out of sun, preferably to an air-conditioned room

2. Cool the body immediately by soaking victim in cool but not cold water, sponging the body with rubbing alcohol or cool water, or pouring water on the body

JOB SHEET #1

3. When victim's body temperature has been reduced to a safe level (about 102° F), stop cooling process and observe the victim for about ten minutes

4. If temperature starts to rise again, cool the victim again

   (NOTE: Use fans, air conditioners, or fan by hand to circulate air and promote cooling. Do not give coffee, tea, or alcoholic beverages.)

5. Transport to hospital immediately

B. Heat exhaustion

   1. Move victim out of sun, preferably to an air-conditioned room

   2. Loosen victim's clothing; apply cool, wet cloths; and fan to promote cooling

   3. Give *sips* of salt water (two pinches of salt per glass of water) every fifteen minutes for an hour

   > **CAUTION**
   >
   > If victim is vomiting, give no fluids. Transport to hospital. Medical care is needed for severe heat exhaustion.

   4. Have victim remain lying down, and raise victim's feet 10 to 12 inches

   5. Caution victim not to return to work for several days and to avoid further prolonged exposure to abnormally warm temperatures

C. Heat cramps

   1. Move victim out of sun, preferably to an air-conditioned room

   2. Apply firm pressure and warm, wet towels to cramped area

   3. Give *sips* of salt water as for heat exhaustion

V. Procedure for burn victim

   A. First-degree burns

      1. Apply cold water or submerge burned area in cold water

      2. Apply a dry, sterile dressing to protect injury if necessary

   B. Second-degree burns

      1. Submerge burned area in cold water until pain eases, or apply cold, wet cloths

         (NOTE: Do not use ice water.)

JOB SHEET #1

2. Blot dry gently with sterile dressing or clean, lint-free cloths

3. Apply dry, sterile dressing, using care not to break blisters

> **CAUTION**
>
> Do not apply cream, ointments, sprays, or other substances to burn.

4. Treat to prevent shock

C. Third-degree burns

1. Cover burn with thick, sterile dressing

> **CAUTION**
>
> Do not apply water or immerse in water.

2. Immobilize burned area as much as possible; avoid removing tissue, clothing, or other materials contacting burned area

3. Treat to prevent shock

4. Transport victim to hospital as quickly as possible

VI. Procedure for victim with foreign object or substance in eye

(NOTE: In an urgent-care situation involving a victim with an object or substance in the eye, flush the eye immediately with water from a water fountain, gently running hose, or faucet. Never use a hose that is fitted with a power nozzle.)

A. Wash hands

B. Explain procedure to victim

C. Position victim on affected side

(NOTE: This is done so that the contaminated fluid does not run from affected eye into good eye.)

D. Moisten a sterile gauze pad with water and clean any debris from eyelid if there is no foreign object in eye

> **CAUTION**
>
> Always wipe from inner to outer side to prevent contamination. If you suspect a foreign object in the eye, do not press on eyelid as that may cause the object to embed.

JOB SHEET #1

E. Use thumb and index finger to open eyelid

F. Flush eye by gently directing a stream of room-temperature water into inner side of eye

> **CAUTION** — Do not touch the edge of the water container to the eye.

G. Flush eye for at least fifteen minutes, especially if condition is caused by a caustic substance

H. Save flushed-out foreign object if this is what has caused the condition

I. Place sterile gauze pad gently over eyelid and face

J. Transport victim to hospital immediately

VII. Procedure for victim with suspected fracture

A. Closed fracture

1. Ask victim what happened and what victim thinks is wrong

2. Examine victim carefully

> **CAUTION** — Do not move or have victim move body parts that may be injured.

(NOTE: After your initial examination, you will know whether an ambulance is needed. If such is the case, ask someone to call for an ambulance while you attend to the victim.)

3. If you cannot get immediate medical help, immobilize the joints above and below suspected fracture with splints, taking care to move the bones as little as possible

(NOTE: There are many types of splints available commercially; however, very satisfactory emergency splints can be made from corrugated cardboard, newspapers, boards, straight sticks, or rolled blankets.)

a. Choose or create a splint long enough to extend past the joints on either side of suspected fracture

b. Slide splints into place, taking care to move the bones as little as possible

c. Place padding (folded cloths, dressings, handkerchiefs, etc.) between splint and skin, especially over bony places

JOB SHEET #1

d. Hold splints in place with strips of cloth torn from clothing, with bandages, neckties, large handkerchiefs, or other suitable material

> **CAUTION**
>
> Do not cut off circulation by tying the cloth strips too tightly.

e. In fractures of the arm or leg, inspect fingers and toes often for swelling or bluish discoloration—signs that the bandages are too tight

f. Loosen bandages and reapply them if these signs appear

4. Elevate limb slightly to reduce hemorrhage and swelling

5. Treat to prevent shock

6. Transport victim to hospital if an ambulance is not needed

B. Open fracture

(NOTE: Open fractures are much more serious than closed fractures because of tissue damage and bleeding, the danger of infection, and the fact that the fracture area is always contaminated.)

1. Remove or cut away victim's clothing in area of suspected fracture

2. Examine victim carefully

> **CAUTION**
>
> Do not move or have victim move body parts that may be injured.

(NOTE: After your initial examination, you will know whether an ambulance is needed. If such is the case, ask someone to call for an ambulance while you attend to the victim.)

3. If bone fragment is *not* protruding, control hemorrhage by applying pressure through a thick, sterile dressing over wound

> **CAUTION**
>
> Do not wash wound, probe wound, or insert your fingers in it.

JOB SHEET #1

4. If bone fragment is protruding, cover entire wound with large, thick, sterile bandage compress or pads; if these are not available, use freshly laundered sheets or towels

CAUTION

Never attempt to set or reduce a fracture or try to push a protruding bone end back in place.

5. If you cannot get immediate medical help, apply splints as described for closed fractures
6. Elevate limb slightly to reduce hemorrhage and swelling
7. Treat to prevent shock
8. Transport victim to hospital if an ambulance is not needed

SAFETY AND BASIC FIRST AID
UNIT V

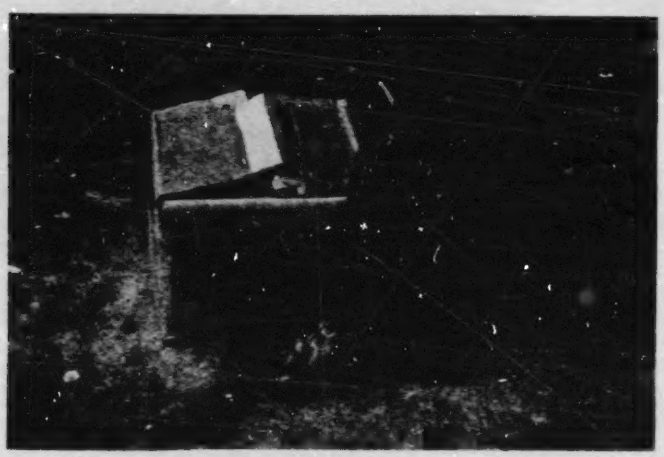
JOB SHEET #2 — PROPERLY LIFT A HEAVY OBJECT

I. Equipment — Heavy object

II. Procedure

A. Step up to object; place one foot beside object and one behind (Figure 15)

FIGURE 15



B. Bend down and grasp object with whole hand (Figure 16)

FIGURE 16

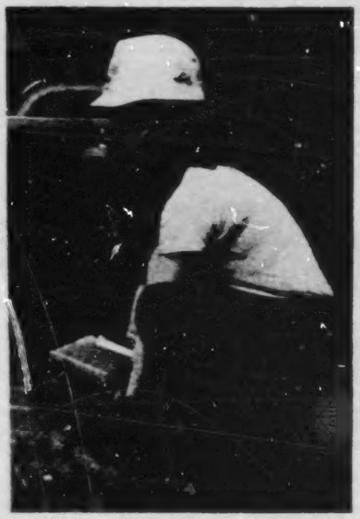
C. Tuck in chin (Figure 17)

FIGURE 17

JOB SHEET #2

D. Tuck in elbows and arms (Figure 18)

FIGURE 18



E. Hold load close to body (Figure 19)

FIGURE 19

F. Keep back straight and body weight directly over feet as you stand up (Figures 20 and 21)

FIGURE 20

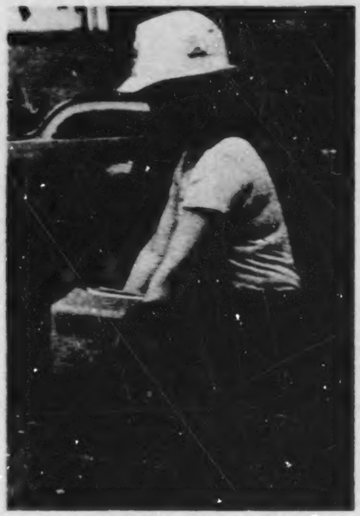


FIGURE 21

SAFETY AND BASIC FIRST AID
UNIT V

TEST

NAME ______________________________ SCORE ______________

1. Match to their correct definitions terms associated with safety and basic first aid. Write the correct numbers in the blanks. Definitions are continued on the next page.

______a. Tending to blow up or burst violently and loudly

______b. Any suddenly occurring, unintentional event that causes injury or property damage

______c. Act of reviving a person by bringing the person back to full consciousness

______d. To put out a fire; to quench or smother

______e. Freedom from danger, risk, or injury

______f. Source of danger

______g. Stored under pressure greater than the pressure of the atmosphere

______h. Any device, such as a bandage and stick, used to compress a blood vessel to stop bleeding or to control blood flow

______i. Negligence; failure to think before one acts, or failure to pay attention

______j. Capable of bursting into flames

______k. Heavy loss of blood

______l. Capable of being easily ignited and burning with extreme rapidity

______m. Immediate, temporary care given to the victim of an accident or sudden illness until the services of a physician can be obtained

______n. Depressed condition of many of the body functions due to failure of enough blood to circulate through the body following serious injury

1. Pressurized
2. Combustible
3. Explosive
4. Carelessness
5. First aid
6. Safety
7. Accident
8. Extinguish
9. Resuscitation
10. Tourniquet
11. Traumatic shock
12. Hemorrhage
13. Open fracture
14. Hazard
15. Flammable
16. Closed fracture

TEST

_____o. Broken bone associated with an open wound

_____p. Broken bone beneath the skin with no open wound

2. State job safety rules for the following categories.

General (State three rules.)

a. ____

____

b. ____

____

c. ____

____

Dress (State three rules.)

a. ____

____

b. ____

____

c. ____

____

Equipment and tools (State six rules.)

a. ____

____

b. ____

____

c. ____

____

TEST

d. ____

____

e. ____

____

f. ____

____

Work area (State six rules.)

a. ____

____

b. ____

____

c. ____

____

d. ____

____

e. ____

____

f. ____

____

Flammable liquids (State five rules.)

a. ____

____

b. ____

____

c. ____

____

TEST

d. ____

____

e. ____

____

Gasoline-powered equipment (State four rules.)

a. ____

____

b. ____

____

c. ____

____

d. ____

____

3. Match colors of the safety color code to their correct applications. Write the correct numbers in the blanks. Answers may be used more than once. Applications are continued on the next page.

_____a. Designates radiation hazards

_____b. Designates safety starter buttons and parts of equipment that may cause electrical shock

_____c. Designates items for housekeeping purposes

_____d. Designates location of first-aid equipment

_____e. Identifies fire-protection equipment and its location

_____f. Designates waste containers for explosive or combustible materials

_____g. Designates caution against and provides information about machines or equipment out of order or under repair

_____h. Designates danger

1. Federal safety red
2. Federal safety yellow
3. Federal safety orange
4. Federal safety purple (or black or magenta on safety yellow)
5. Federal safety blue
6. Federal safety green
7. Federal safety black and white (used individually or in combination)

TEST

_____i. Designates exposed parts (edges only) of pulleys, gears, rollers, cutting devices, and power jaws

_____j. Designates caution against starting, using, or moving equipment while it is under repair, and against the use of defective equipment

_____k. Designates storage areas

_____l. Designates dangerous parts of equipment that may cut, crush, shock, or otherwise injure

_____m. Identifies portable containers of flammable liquids

_____n. Designates location of safety equipment other than fire-fighting equipment

_____o. Identifies emergency stop bars, stop buttons, and emergency electrical stop switches on machinery

_____p. Identifies out-of-order signs on equipment

_____q. Identifies the starting point or power source of machinery

_____r. Designates traffic flow

_____s. Designates caution and marks physical hazards

4. Match classes of fires to their correct descriptions. Write the correct numbers in the blanks.

_____a. Fires that occur with flammable liquids such as gasoline, oil, grease, paint, and thinners

_____b. Fires that occur in ordinary combustible materials such as wood, rags, rubber, and plastics

_____c. Fires that occur in or near electrical equipment such as motors, switchboards, and electrical wiring

_____d. Fires that occur with combustible metals such as iron, magnesium, sodium, and potassium

1. Class A
2. Class B
3. Class C
4. Class D

TEST

5. Discuss why knowledge of first aid is important.

____

____

____

____

____

____

____

____

6. Arrange in order first-aid actions to follow in an emergency. Write a "1" in the blank before the first step, a "2" in the blank before the second step, and so on.

_____a. Control heavy bleeding

_____b. Restore or maintain breathing and heartbeat

_____c. Rescue victim and yourself

_____d. Examine victim carefully

_____e. Treat for poisoning

_____f. Prevent shock

_____g. Keep checking and assisting victim until medical help is obtained

_____h. Seek medical help

7. List carpentry-related injuries that require the administration of first aid.

a. ____

b. ____

c. ____

d. ____

e. ____

TEST

f. ______________________

g. ______________________

8. Discuss symptoms of traumatic shock.

Early stages

Late stages

9. State four measures to take for prevention of heat stroke, heat cramps, and heat exhaustion.

a. ______________________

b. ______________________

c. ______________________

d. ______________________

TEST

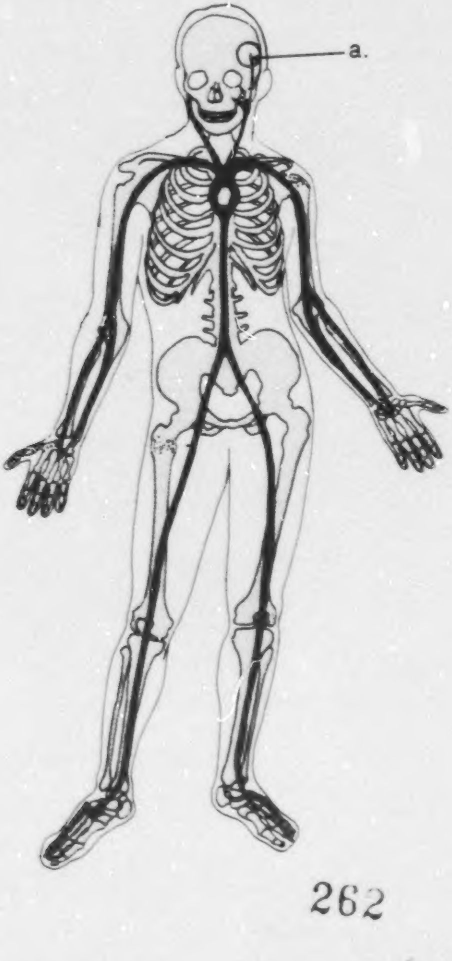
10. Distinguish between symptoms of heat stroke and heat exhaustion. Write an "X" in the blank before symptoms of heat stroke.

_____a. Flushed, hot, dry skin and high body temperature

_____b. Pale, cool, clammy skin and normal body temperature

11. Identify pressure points to use to control bleeding from various areas of the body. Circle the pressure points on the illustration below, and label each with the letter that corresponds to the area of bleeding it controls. (Pressure point "a" is shown as an example.)

a. Bleeding from scalp
b. Bleeding from face
c. Bleeding from thigh
d. Bleeding from lower leg
e. Bleeding from lower arm or elbow
f. Bleeding from upper arm or shoulder
g. Bleeding from neck
h. Bleeding from foot
i. Bleeding from lower arm or hand



TEST

12. Classify burns by degree according to their symptoms. Write a "1" in the blanks before symptoms of first-degree burns, a "2" before symptoms of second-degree burns, and a "3" in the blanks before symptoms of third-degree burns.

______a Damage extending into first layer of tissue

______b. Less pain because of nerve destruction

______c. Rapid healing

______d. Blistering

______e. Charred or white appearance of burned area

______f. Mild swelling and pain

______g. Considerable swelling

______h. Pain greater than that caused by first-degree burn

______i. Deep tissue destruction

______j. Wet appearance of burned area due to loss of plasma

______k. Redness or discoloration

______l. Mottled or red areas

13. List guidelines for administering first aid to a victim with an eye injury.

a. ____

____

b. ____

____

c. ____

____

d. ____

____

e. ____

____

TEST

14. Discuss signs and symptoms of fractures.

15. List six guidelines for administering first aid to a victim with a suspected fracture.

    a.

    b.

    d.

    e.

    f.

(NOTE: Test question 16 lists the job sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

16. Demonstrate the ability to

    a. Perform first-aid treatment for simulated accident victims.

    b. Properly lift a heavy object.

SAFETY AND BASIC FIRST AID
UNIT V

ANSWERS TO TEST

1. a. 3
   b. 7
   c. 9
   d. 8
   e. 6
   f. 14
   g. 1
   h. 10
   i. 4
   j. 2
   k. 12
   l. 15
   m. 5
   n. 11
   o. 13
   p. 16

2. **General** — Answer should include any three of the following

   a. Be familiar with location of fire-fighting and first-aid equipment
   b. Be alert and conduct yourself in a manner that will ensure safe practices
   c. Be conscious of others' safety
   d. Report all accidents to the supervisor, regardless of nature or severity

   Dress — Answer should include any three of the following

   a. Wear close-fitting clothing appropriate for activity being performed
   b. Confine long hair before operating power equipment
   c. Wear safety glasses, suitable hard hat, goggles, safety shoes, gloves, ear protection, and respiratory equipment when required
   d. Remove rings and other jewelry when working
   e. Do not carry sharp tools in pockets

   Equipment and tools — Answer should include any six of the following

   a. Obey all safety rules, and observe limitations on equipment according to specifications and manufacturer's requirements
   b. Keep all tools sharp and clean, in safe working order, and properly stored when not in use
   c. Retain guards and safety devices on all equipment
   d. Tag and report to the supervisor any defective tools, machines, or other equipment
   e. Be sure to shut off all power equipment when finished with it, and do not leave equipment until it has stopped completely
   f. Operate equipment *only after* receiving instructions on how to operate it safely
   g. Disconnect power from equipment before changing accessories and before performing service or maintenance on it
   h. Use the correct tool for the job
   i. Clean chips from saws, grinders, and other equipment with a brush, not with your hands or a rag; *do not* clean equipment while it is running

   Work area — Answer should include any six of the following

   a. Arrange equipment to permit safety-efficient work practices and ease of cleaning
   b. Store materials and supplies safely in their proper places

ANSWERS TO TEST

c. Store tools and accessories safely in cabinets, on racks, or in suitable storage areas
d. Keep work area clear of debris and other hazards
e. Always pull nails from wood before throwing it aside
f. Clean floors of obstructions and slippery substances; clean up spills immediately
g. Keep aisles, exits, and traffic areas free of materials and debris
h. Dispose of combustible materials properly
i. Keep sufficient brooms, brushes, waste containers, and other housekeeping equipment readily available

Flammable liquids — Answer should include any five of the following

a. Carefully read labels on all flammable liquids, and use only in open, well-ventilated areas
b. Be sure that all flammable liquids are marked correctly for storage
c. Store all flammable liquids properly in approved safety containers
d. Immediately change clothing soaked by flammable liquids
e. Use flammable liquids only for their intended purposes
f. Do not use flammable liquids near fire or flame
g. Always know location of appropriate fire extinguisher
h. Stop, drop, and roll if your hair or clothing catches fire; *never* run

Gasoline-powered equipment — Answer should include any four of the following

a. Use caution to prevent contact with hot manifolds and hoses
b. Be sure that engine is out of gear before starting
c. Always keep appropriate fire extinguisher near when starting and operating gasoline-powered equipment
d. Do not pour gasoline into carburetor or cylinder head when starting engine
e. Never pour gasoline into fuel tank when engine is hot or when engine is running
f. Do not operate equipment that is leaking gasoline
g. Stop, drop, and roll if your hair or clothing catches fire; *never* run

3. a. 4
b. 3
c. 7
d. 6
e. 1
f. 2
g. 5
h. 1
i. 3
j. 2
k. 7
l. 3
m. 1
n. 6
o. 1
p. 5
q. 2
r. 7
s. 2

4. a. 2
b. 1
c. 3
d. 4

5. Discussion should include the following

a. May mean the difference between life and death

ANSWERS TO TEST

b. May mean the difference between temporary and permanent disability
c. May mean the difference between rapid recovery and long hospitalization
d. Prepares one for what to do and what not to do in an emergency
e. Promotes safety awareness

6. a. 3
b. 2
c. 1
d. 6
e. 4
f. 5
g. 8
h. 7

7. a. Bleeding
b. Burns
c. Loss of consciousness
d. Respiratory failure/cardiac arrest
e. Eye injuries
f. Muscle and ligament strain or sprain
g. Broken bones

8. Discussion should include the following

Early stages
a. Pale or bluish skin that is cold to the touch
b. Moist, clammy skin if perspiration has occurred
c. Weakness
d. Rapid pulse (over 100 beats/minute), often too faint to be felt in wrist but perceptible in carotid artery at the side of neck or femoral artery at groin
e. Increased rate of breathing that may be shallow or possibly deep and irregular
f. Restlessness, anxiousness, severe thirst if victim is in shock from hemorrhage
g. Vomiting or nausea

Late stages
a. Apathy and relative lack of responsiveness
b. Sunken eyes with vacant expression and widely dilated pupils
c. Mottled appearance to skin, indicating that victim's blood pressure has fallen to a very low level
d. Loss of consciousness, low body temperature, and death if untreated

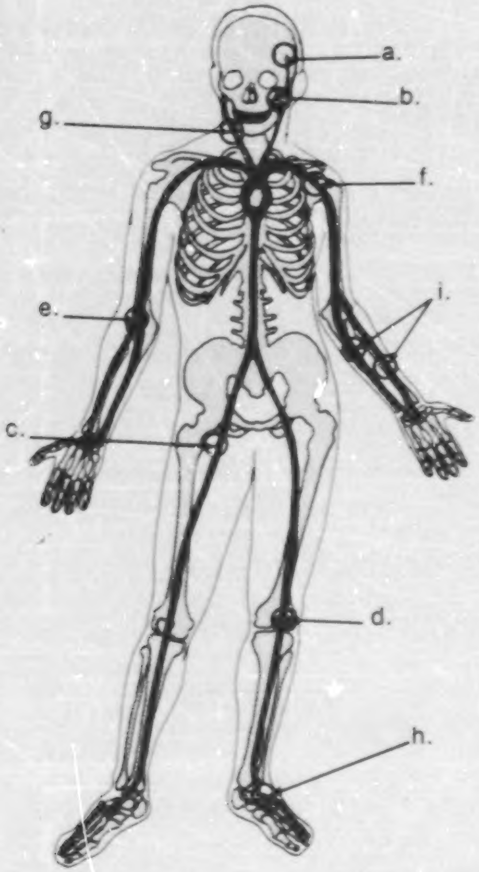
9. Answer should include any four of the following

a. Drink plenty of fluids
b. Increase salt intake
c. Do not overexert
d. Wear lightweight clothing that allows sweat to evaporate
e. Keep head covered and face shaded
f. Take frequent short work breaks
g. Rest in the shade or an air-conditioned room whenever possible

ANSWERS TO TEST

10. a

11.



12. a.	2	d.	2	g.	2	j.	2
b.	3	e.	3	h.	2	k.	1
c.	1	f.	1	i.	3	l.	2

13.
a. Do not let victim rub the eye
b. Do not attempt to remove a foreign object by using any sharp object
c. Keep victim flat on back if injury is caused by a penetrating object or a severe blow
d. Cover eye with a clean dressing if foreign object is lodged in eye and cannot be removed easily by flushing with water or by using a clean cloth
e. Immediately flood chemical substances in eye with water

14. Discussion should include the following

a. Victim's account of accident
b. Differences in shape and length of corresponding bones on the two sides of body

ANSWERS TO TEST

c. Obvious deformities
d. Swelling
e. Discoloration
f. Pain or tenderness to touch

15. Answer should include any six of the following

    a. Prevent motion of the injured parts and adjacent joints
    b. When an injured person obviously requires hospitalization and an ambulance is on the way, do not attempt to move the victim unless there is a life-threatening emergency
    c. Give priority to open fractures over closed fractures unless associated injuries dictate otherwise
    d. Never test for fracture by having the victim move the part or try to walk on a possibly broken leg
    e. Never attempt to set or reduce a fracture or try to push a protruding bone end back in place
    f. If possible, take time to tie a victim's injured leg to the uninjured one, or to bind the injured arm to the chest or side
    g. Do not allow victim to move the head (or do not move it yourself) when there is a possible neck or spine fracture
    h. Lift and move an unconscious victim as though the injury is to the neck or spine—provide rigid support for victim's back and head
    i. After providing urgent care, treat to prevent shock

16. Performance skills evaluated to the satisfaction of the instructor

BASIC MATH
UNIT I

UNIT OBJECTIVE

After completing this unit, the student should be able to solve basic math problems. The student will show this knowledge by completing assignment sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match to their correct definitions terms associated with basic math.
2. Match to their correct names symbols used in math problems.
3. Label the place values of a whole number.
4. Add whole numbers.
5. Subtract whole numbers.
6. Multiply whole numbers.
7. Divide whole numbers.
8. Distinguish among types of fractions.
9. Reduce fractions to lowest terms.
10. Convert mixed numbers to improper fractions.
11. Convert improper fractions to mixed numbers.
12. Add fractions.
13. Subtract fractions.
14. Multiply fractions.
15. Label the place values of a decimal number.
16. Add decimal numbers.
17. Subtract decimal numbers.
18. Multiply decimal numbers.

OBJECTIVE SHEET

19. Divide decimal numbers.
20. Convert fractions to decimal numbers and percentages.
21. Identify decimal and fractional equivalents.
22. Convert percentages to fractions and decimal numbers.
23. Solve percentage problems.
24. Match terms used in geometry to their correct definitions.
25. Match types of geometric figures to their correct descriptions.
26. Match units of measure to their correct equivalents.
27. Calculate area of geometric figures.
28. Calculate volume of solid figures.
29. Solve basic ratio and proportion problems.

BASIC MATH
UNIT I

SUGGESTED ACTIVITIES

I. Unit contents

   A. Objective sheet

   B. Suggested activities

      1. Supplements

         a. Supplement #1 — Crossword Puzzle of Basic Math Terms

         b. Supplement #2 — Subtraction Squares

         c. Supplement #3 — Geometry Terms Word Search

      2. Answers to supplements

   C. Transparency masters

      1. TM #1 — Area of a Parallelogram

      2. TM #2 — Area of a Circle

      3. TM #3 — Ratio and Proportion

   D. Information sheet

   E. Assignment sheets

      1. Assignment Sheet #1 — Add Whole Numbers

      2. Assignment Sheet #2 — Subtract Whole Numbers

      3. Assignment Sheet #3 — Multiply Whole Numbers

      4. Assignment Sheet #4 — Divide Whole Numbers

      5. Assignment Sheet #5 — Work with Fractions

      6. Assignment Sheet #6 — Reduce Fractions to Lowest Terms

      7. Assignment Sheet #7 — Convert Unlike Fractions to Like Fractions

      8. Assignment Sheet #8 — Convert Fractions and Mixed Numbers

      9. Assignment Sheet #9 — Add Fractions

SUGGESTED ACTIVITIES

10. Assignment Sheet #10 — Subtract Fractions
11. Assignment Sheet #11 — Multiply Fractions
12. Assignment Sheet #12 — Add Decimal Numbers
13. Assignment Sheet #13 — Subtract Decimal Numbers
14. Assignment Sheet #14 — Multiply Decimal Numbers
15. Assignment Sheet #15 — Divide Decimal Numbers
16. Assignment Sheet #16 — Convert Fractions and Percentages
17. Assignment Sheet #17 — Solve Percentage Problems
18. Assignment Sheet #18 — Calculate Area
19. Assignment Sheet #19 — Calculate Volume
20. Assignment Sheet #20 — Estimate Cubic Yards
21. Assignment Sheet #21 — Solve Basic Ratio and Proportion Problems

F. Answers to assignment sheets

G. Test

H. Answers to test

II. Instructor's guide

A. Obtain materials to supplement unit.

1. Films

2. Books

a. *Speaking of Numbers*. This self-instructional workbook/textbook series is intended for use with two groups of students: 1) beginning English-as-a-Second-Language students who are concurrently studying English and basic mathematic skills; and 2) native speakers of English who require remediation and reinforcement in numbers and arithmetic operations.

(NOTE: *Speaking of Numbers* is available from the Institute of Modern Languages, 2622 Pittman Drive, Silver Spring, Maryland 20910.)

SUGGESTED ACTIVITIES

b. *Math*. This book is part of a series of manuals developed specifically for special needs programs for disadvantaged and handicapped students. Seven areas of instruction have assignment sheets specifically designed to acquaint students with basic and practical mathematical problems and terms directly related to vocational skill trades. The guide contains instruction in measurement, whole numbers, fractions, decimals, percentages, consumer education, and geometry.

(NOTE: *Math* is available from the Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074.)

3. Transparencies and competency profiles

(NOTE: Transparencies and competency profiles for this book are available from the Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074, or from The Associated General Contractors of America, 1957 E Street, N.W., Washington, D.C. 20006. Phone [202] 393-2040.)

B. Make additional transparencies and additional copies of assignment sheets and supplements if needed.

C. Use the assignment sheets (of parts of them) to pretest students in each math concept. Those students who demonstrate proficiency and an understanding of the concept may use the assignment sheets as a review or may be paired with those students who need help in mastering the concepts.

D. Provide students with objective sheet.

E. Discuss unit and specific objectives.

1. Introduce unit by discussing the technological explosion presently underway in the world and its effects on our lives. Emphasize the increased demand for technical skills.

2. Point out that an understanding of mathematical concepts, a grasp of analytical logic, accuracy in computational skills, and the ability to apply these skills to a wide variety of situations are essential to getting and keeping a job.

SUGGESTED ACTIVITIES

F. Provide students with information and assignment sheets.

G. Discuss information and assignment sheets.

1. Use Information Sheet, Section I to discuss terms associated with basic math.

   SUGGESTIONS:

   - Point out the importance of defining terms for common understanding.
   - Have students complete Supplement #1 as a review of terms.

2. Use Information Sheet, Section II to discuss symbols used in math problems.

   SUGGESTIONS:

   - Prepare examples of problems using the symbols.
   - Have students discuss where they have seen the math symbols used.

3. Use Information Sheet, Sections III and IV and Assignment Sheet #1 to discuss addition.

   SUGGESTIONS:

   - Play "You Inherit" with the students to help them learn place values. Ask students to tell you the least amount they inherit when you give them the amount in numbers of digits.

     EXAMPLE: Q. You have just inherited a six-digit sum. What is the least amount you inherit?
     A. One hundred thousand dollars

   - Prepare groups of objects such as bottle caps, books, tacks, nails, boards, and crayons to be added at different tables. Have students stop at each table and perform the addition as directed. Provide each student with a work sheet on which the equation and answer could be written.

     (NOTE: Similar situations could be set up for subtraction.)

   - Have students play dominoes. Score ends in multiples of five and play to 250, or score ends at end of each turn and play to 1,000 points.

SUGGESTED ACTIVITIES

4. Use Information Sheet, Section V and Assignment Sheet #2 to discuss subtraction.

   SUGGESTIONS:

   - Develop a set of flash cards containing various subtraction problems. Show students each card and have them give you the correct answer, either orally or written on a sheet of paper.
   - Use spinner and game boards. Each student spins twice, writes down each number, subtracts the difference and moves the marker the appropriate number of jumps.
   - Have students practice subtraction by completing Supplement #2.

     (NOTE: You may want to prepare similar squares for addition, multiplication, and division with whole numbers, fractions, or decimals; or for calculations with exponents and square roots of the perfect square.)

5. Use Information Sheet, Section VI and Assignment Sheet #3 to discuss multiplication.

   SUGGESTIONS:

   - Obtain or make multiplication table to 12. Have students learn the table.
   - Sit students in a circle. Have all students clap hands twice on legs, then clap hands together twice, then snap fingers twice to establish a rhythm that is to continue unbroken throughout the game. The caller gives a multiplication (or other operation) problem such as 8 × 6 while snapping fingers, and at the next finger snapping says the name of someone to answer the problem. The responder gives answer at next finger snapping without breaking the clap/snap rhythm. If the responder maintains the rhythm and gives the correct answer, then he or she becomes the next caller. If the responder breaks the rhythm or gives an incorrect answer, then he or she is out of the game. The last person left is the winner.

6. Use Information Sheet, Section VII and Assignment Sheet #4 to discuss division.

   SUGGESTION:

   - For students who consistently cannot make the appropriate decisions to solve long-division exercises, try the "decision-free," step-by-step procedure on the next page.

SUGGESTED ACTIVITIES

a. Copy the problem.

b. Draw a vertical line to the right of the problem.

c. Make a guess and write that down to the right of the vertical line.

d. Multiply the guess by the divisor and subtract from the original number.

e. Repeat the process until subtracting produces a number smaller than divisor.

52)86310	
52000	1000
34310	
20800	400
13510	
10400	200
3110	
2600	50
510	
416	8
94	
52	1
42	1659

f. The answer is the sum of the guesses.

g. Check by multiplying the answer times the divisor and adding the remainder. If the problem has been solved correctly, the resulting sum should equal the original number inside the division frame.

EXAMPLE:

1659	Answer
× 52	Divisor
3318	
8295	
86268	
+ 42	Remainder
86310	Sum Equal to Original Number

7. Use Information Sheet, Section VIII, and Assignment Sheet #5 to discuss types of fractions.

SUGGESTIONS:

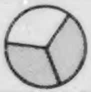
- Write a proper fraction, such as $^{3}/_{8}$, on the chalkboard. Label the fraction's nominator and denominator. Explain that the denominator of this (or any) fraction represents the way the unit has been split. Illustrate this point by drawing on the chalkboard a circle split into eight parts. Now explain that the numerator of this (or any) fraction represents the number of parts involved in the calculation. Therefore the fraction $^{3}/_{8}$ indicates three parts of something that has been divided into eight parts. Shade in three of the eight parts of the circle to illustrate this point.

SUGGESTED ACTIVITIES

- Make two decks of cards. Show fractions on one deck and the corresponding pictures on the other deck.

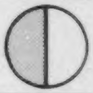
  EXAMPLE:

  2/3

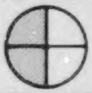


  Cards can also be made to show equivalent fractions, using pictures and fractions.

  EXAMPLE:



  1/2



  2/4

  Students may play a game of matching or rummy by making pairs that match.

8. Use Information Sheet, Section IX and Assignment Sheets #6 and #7 to discuss reducing fractions to the lowest terms and converting unlike fractions to like fractions.

   SUGGESTIONS:

   - Prepare twenty-four tagboard flash cards. On each card, write two or three unlike fractions.

     EXAMPLES:

     1/2 3/8 3/4

     3/5 2/3 1/6

     Laminate the cards. Have students number their papers from 1 to 24; then give them fifteen seconds to write the least common denominator for the fractions on each flash card shown. To increase the difficulty, shorten the time-span for calculating each lowest common denominator.

   - Use these flash cards to review addition, subtraction, and multiplication of fractions.

SUGGESTED ACTIVITIES

9. Use Information Sheet, Sections X and XI and Assignment Sheet #8 to discuss converting mixed numbers to improper fractions and converting improper fractions to mixed numbers.

   SUGGESTION:

   - Have students practice measuring with rulers by measuring various items in the classroom: length of books, length and width of desk or table, height of chairs, length of pencil, and so on. Have students record their measurements on a sheet of paper, and then have them convert their measurements into improper fractions. After they have the improper fractions, have them give their lists to another student who then converts the improper fractions to mixed numbers.

10. Use Information Sheet, Section XII and Assignment Sheet #9 to discuss adding fractions.

11. Use Information Sheet, Section XIII and Assignment Sheet #10 to discuss subtracting fractions.

12. Use Information Sheet, Section XIV and Assignment Sheet #11 to discuss multiplying fractions.

13. Use Information Sheet, Section XV to discuss the place values of decimals.

    SUGGESTION:

    - Have students write down several decimal numbers. Have students write out the decimal number by place values, i.e., tenths, hundredths, thousandths, ten thousandths, millionths.

14. Use Information Sheet, Section XVI and Assignment Sheet #12 to discuss adding decimal numbers.

    SUGGESTION:

    - Assign a monetary value to each letter of the alphabet: A = $0.50, B = $1.00, C = $1.50 . . . Z = $13.00. Then have students calculate such problems as who has the most valuable name? What carpentry hand tool has the most valuable name? What carpentry power tool has the most valuable name?

      (NOTE: This activity can be adapted and used to practice multiplication of whole numbers, or for practice with fractions.)

15. Use Information Sheet, Section XVII and Assignment Sheet #13 to discuss subtracting decimal numbers. Emphasize the importance of checking answers.

16. Use Information Sheet, Section XVIII and Assignment Sheet #14 to discuss multiplying decimal numbers.

SUGGESTED ACTIVITIES

SUGGESTION:

- Increase student speed in certain multiplication problems by giving timed tests in which the student must use the following shortcuts.

  To multiply by

  5, 50, 500 etc., just multiply by 10, 100, 1000, etc., and divide by 2;

  25, 250, 2500, etc., just multiply by 100, 1000, etc., and divide by 4;

  33⅓, 16⅔, 12½, 8⅓, 6¼ multiply by 100 and divide by 3, 6, 8, 12, 16, respectively.

17. Use Information Sheet, Section XIX and Assignment Sheet #15 to discuss dividing decimal numbers.

SUGGESTION:

- Increase student speed in certain division problems by giving timed tests in which students use the following shortcuts.

  To divide by

  3⅓, multiply by 3 and divide by 10;

  33⅓, multiply by 3 and divide by 100;

  16⅔, multiply by 6 and divide by 100;

  25, multiply by 4 and divide by 100;

  50, multiply by 2 and divide by 100.

  (NOTE: There are other shortcuts that you may want to add to this list and the list of multiplication shortcuts.)

18. Use Information Sheet, Sections XX through XXIII and Assignment Sheets #16 and #17 to discuss fractional equivalents and the conversion of fractions and decimals.

SUGGESTIONS:

- Before presenting rules for converting fractions to decimals, have students solve problems by converting the decimals to fractions. The answer from the computation with the equivalent fractions must then be converted back to a decimal form. A half dozen exercises like this for each decimal rule may help students appreciate the benefits of learning the rules and why the decimal rules work.

SUGGESTED ACTIVITIES

EXAMPLE: $5.67 + 3.2 + 4.104 = 5\frac{670}{1000} + 3\frac{200}{1000} + 4\frac{104}{1000}$

$= 12\frac{974}{1000}$

$= 12.974$

- Obtain a set of twist drills and a drill index. Take the drills out of the drill index. Have students replace drills in the index, noting the decimal and fractional differences in the drill sizes.

- Obtain a quantity of pocket-sized decimal equivalent charts from your local tool supplier. Give one to each student.

- Illustrate percentages by providing students with graph or grid paper. Have students outline at least eight 10-by-10-block squares. Since each block contains 100 units or small squares, students can shade in enough units to illustrate 25 percent, 33⅓ percent, 50 percent, 96 percent, and so on.

19. Use Information Sheet, Section XXIV to discuss terms used in geometry.

SUGGESTION:

- Have students review the terms by completing Supplement #3.

20. Use Information Sheet, Section XXV to discuss types of geometric figures.

SUGGESTIONS:

- Develop a bulletin board display showing types of geometric figures.

- Prepare poster-board cutouts of each geometric figure. As you discuss each figure, attach the cutout to the chalkboard (with masking tape on back) or attach the cutout to a clothesline. When discussion is completed, students will be able to observe the differences among the types of geometric figures.

21. Use Information Sheet, Section XXVI to discuss common units of measure and their equivalents.

SUGGESTIONS:

- Have students practice measuring with a tape measure. Use various lengths of lumber. Have students measure width, thickness, and length of each piece and write their answers on a sheet or paper. As additional practice, you could have students convert all fractions to decimals.

SUGGESTED ACTIVITIES

- Illustrate the length of a rod by measuring and marking a 16 ½-foot line on your classroom floor.

22. Use Information Sheet, Section XXVII and Assignment Sheet #18 to discuss formulas for calculating areas of geometric figures.

    SUGGESTIONS:

    - Use Transparencies #1 and #2 to illustrate formulas for figuring the area of a square, a rectangle, or a circle.

    - Floor plans of homes can be a source for a variety of mathematical problems. Sample floor plans may be obtained from blueprints of homes, newspapers, or perhaps from old real-estate-agency listings. Some students may prefer to design their own floor plans. Provide students with a floor plan and have them calculate the total square feet in the home and the square feet for each room.

23. Use Information Sheet, Section XXVIII and Assignment Sheets #19 and #20 to discuss calculating the volume of solid figures.

    SUGGESTION:

    - Visit a construction site before concrete is to be poured. Have students measure forms and determine the volume of concrete that will be needed. You may want to have the students determine the total cost of the concrete, also.

24. Use Information Sheet, Section XXIX and Assignment Sheet #21 to discuss ratio and proportion.

    SUGGESTION:

    - Use Transparency #3 to illustrate ratio and proportion.

H. Give test.

(NOTE: It is recommended that this test be given in parts, such as the math processes, fractions, and decimals.)

I. Critique test and discuss in class.

J. Reteach if necessary.

K. Complete appropriate section of competency profiles.

SUGGESTED ACTIVITIES

III. Unit references

A. Gossage, Loyce G., and Milton Briggs. *Basic Mathematics Review.* Cincinnati, Ohio: South-Western Publishing Co., 1969.

B. Hendrix, Laborn J. "Bud." *Bricklaying Curriculum: Basic Core.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and The Associated General Contractors of America, 1983.

C. Hendrix, Laborn J. "Bud." *Heavy Equipment Operator Instructional Materials, Volume I.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and The Associated General Contractors of America, 1981.

D. *Math One.* Oklahoma City, Oklahoma: Oklahoma Department of Transportation, 1970.

E. Morrison, Phyllis. *Basic Math Skills.* New York: McGraw-Hill Book Company, 1972.

F. Turcotte, Raymond J. *Bricklaying Curriculum Instructional Units.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and The Associated General Contractors of America, 1977.

SUGGESTED ACTIVITIES

SUPPLEMENT #1 — CROSSWORD PUZZLE OF BASIC MATH TERMS

NAME ______________________________ SCORE ______________

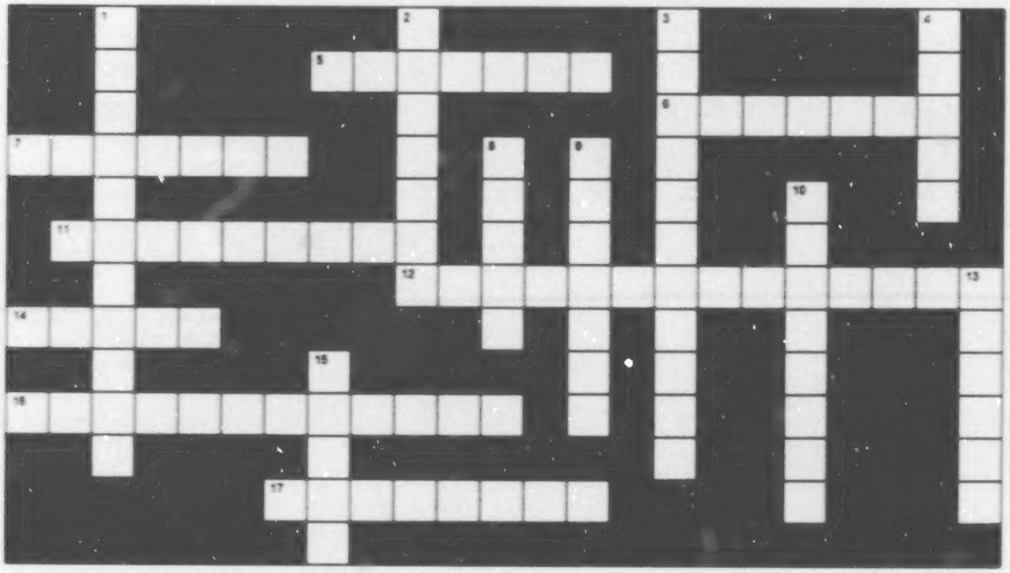
To help you review the terms used in this unit, use the clues below to complete the following crossword puzzle.

ACROSS

5. One part in a hundred; reckoned on the basis of a whole divided into one hundred parts
6. Pertaining to nominal units based on a 4-inch module
7. Any of the natural numbers; the whole numbers, positive and negative
11. To solve by mathematical process
12. Abbreviated process of adding an integer to itself a specified number of times
14. Relationship in quantity, amount, or size between two or more things; expressed with ratio symbol
16. Being relatively equal in size or quantity
17. Opposite (inverse) operation of multiplication

DOWN

1. Opposite (inverse) operation of addition
2. Mathematical proposition
3. Theoretical size that may vary from the actual (2 wds.)
4. Inverted "V" symbol used to indicate where something is to be inserted
8. With 13 Down, any of the integers that represents a complete item
9. Fraction with an unwritten denominator of 10 or some power of 10, indicated with a point before the numerator
10. Part of a whole; represents one or more equal parts of a unit
13. See 8 Down
15. Any one of the ten symbols, 0 to 9, by which all numbers can be expressed



SUGGESTED ACTIVITIES

SUPPLEMENT #2 — SUBTRACTION SQUARES

Cut out the sixteen squares shown below and then fit them together so that the edges that touch form a problem and its correct solution. For better durability, glue the sheet to heavy poster board before cutting out squares.

10-5 6 9-1 8-1	8 10-7 15-5 12-2	9-4 5	11-2 2
6 6-2 12-6 10-2	7 10 6-4 9-6	4-0 7	0 12-3
7-4 2 4	3 10-6 9-2	10 8-3 4	4 3 5
9 8 3	1 8-8 5	9 7-6 9-3	8-6 4 7-3

SUGGESTED ACTIVITIES

SUPPLEMENT #3 — GEOMETRY TERMS WORD SEARCH

The following geometry terms are hidden in the puzzle below. Find and circle each term. Words may be spelled forward, backward, from top to bottom, or diagonally. A score of 8 is good, 10 is excellent, and 13 to 14 is super.

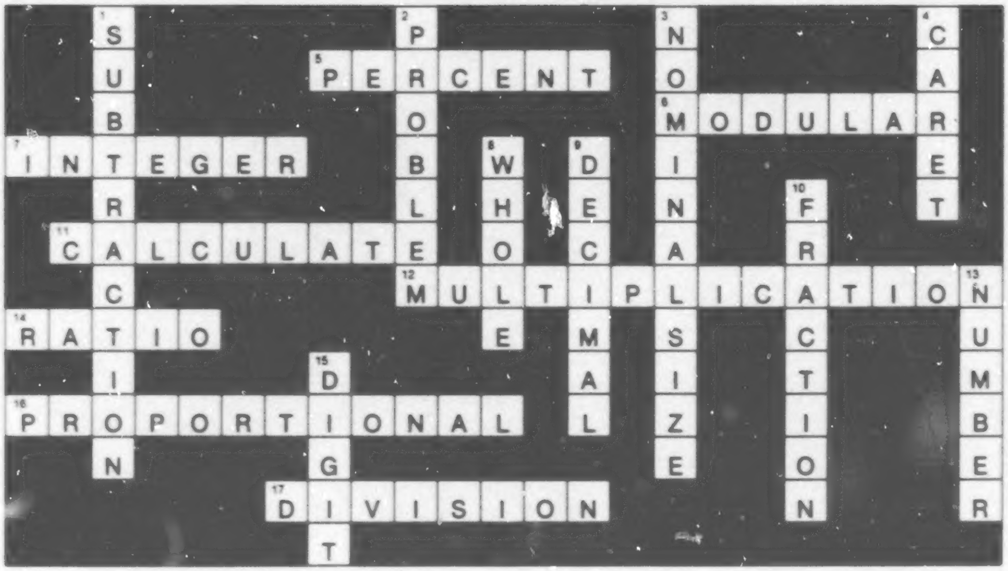
- GEOMETRIC FIGURES
- PERIMETER
- LINEAL
- PARALLEL
- PERPENDICULAR
- RIGHT ANGLE
- RADIUS
- DIAMETER
- CIRCUMFERENCE
- PI
- AREA
- VOLUME
- CUBIC UNIT
- CUBIC FOOT

G	B	F	P	E	R	I	M	E	T	E	R	R	D	C	L
K	E	N	Q	Y	S	Z	V	O	L	U	M	E	J	I	I
T	O	O	F	C	I	B	U	C	B	F	K	T	Z	R	N
D	N	M	M	K	W	N	V	C	B	H	I	E	L	C	E
U	B	M	J	E	G	J	K	P	I	N	F	M	M	U	A
G	K	R	C	H	T	L	A	D	U	D	L	A	B	M	L
X	S	U	I	D	A	R	Q	C	R	H	L	I	C	F	Q
C	G	R	M	G	A	G	I	H	S	T	S	D	R	E	M
F	C	G	J	L	E	B	L	C	K	G	M	P	B	R	R
G	K	N	L	V	U	C	B	W	F	T	M	S	R	E	D
R	S	E	D	C	D	B	C	F	T	I	L	J	N	N	P
B	L	D	T	R	I	G	H	T	A	N	G	L	E	C	T
P	G	X	C	W	M	D	S	N	W	H	C	U	Q	E	P
W	A	E	R	A	D	P	G	B	F	C	D	H	R	L	N
C	L	S	W	R	T	R	G	V	Y	M	B	H	B	E	W
P	E	R	P	E	N	D	I	C	U	L	A	R	X	C	S

SUGGESTED ACTIVITIES

ANSWERS TO SUPPLEMENTS

Supplement #1


1 SUBTRACTION
2 PROBLEM
3 NOMINAL SIZE
4 CARET
5 PERCENT
6 MODULAR
7 INTEGER
8 WHOLE
9 DECIMAL
10 FRACTION
11 CALCULATE
12 MULTIPLICATION
13 NUMBER
14 RATIO
15 DIGIT
16 PROPORTIONAL
17 DIVISION

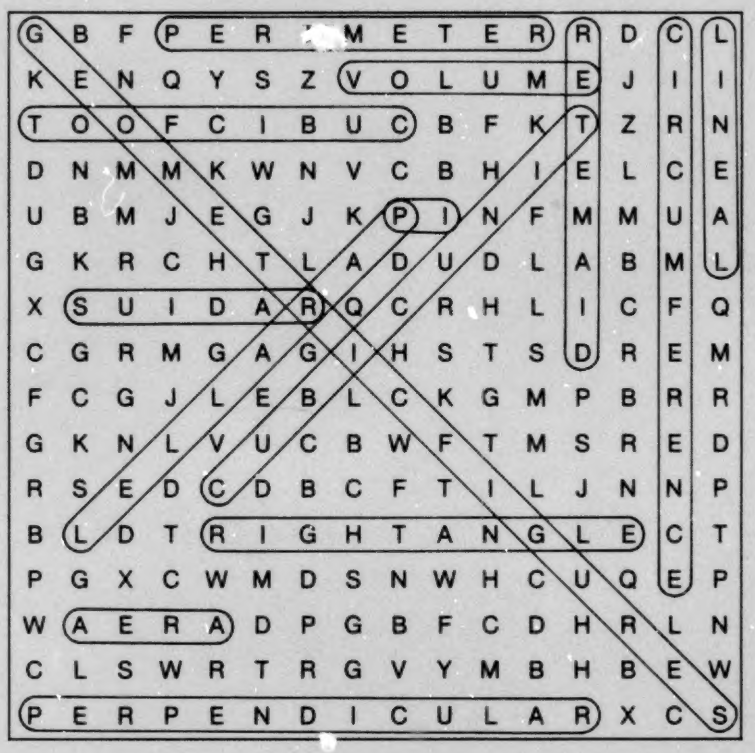
ANSWERS TO SUPPLEMENTS

Supplement #2

11−2 2	9 7−6 9−3	1 8−8 5	0 12−3
8−6 4 7−3	6 6−2 12−6 10−2	10−5 6 9−1 8−1	9 8 3
4 3 5	8 10−7 15−5 12−2	7 10 6−4 9−6	7−4 2 4
9−4 5	10 8−3 4	3 10−6 9−2	4−0 7

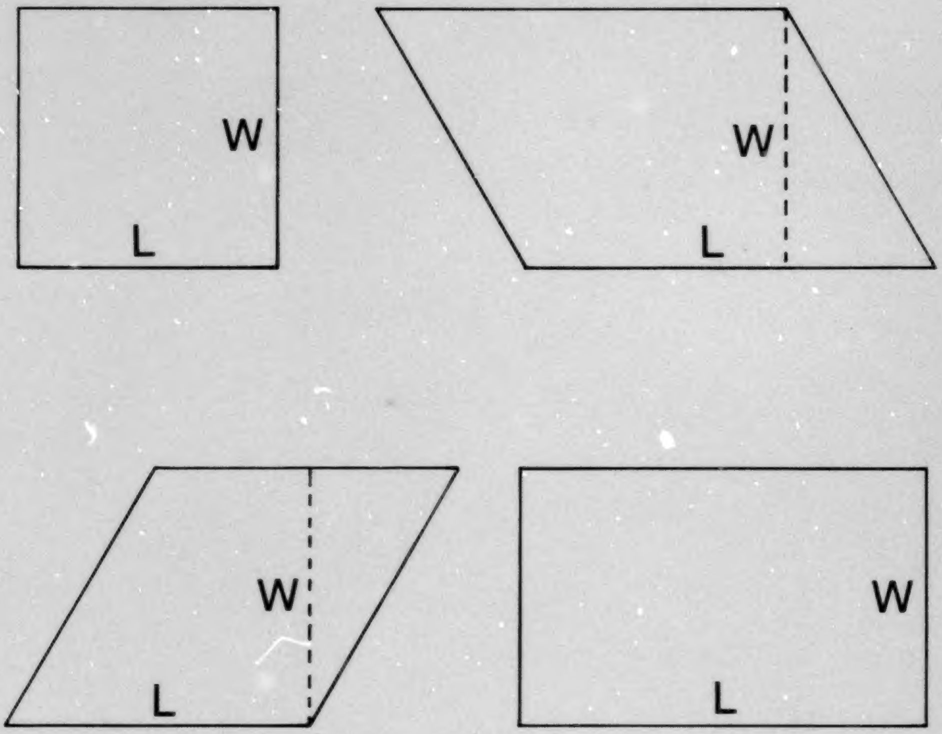
ANSWERS TO SUPPLEMENTS

Supplement #3



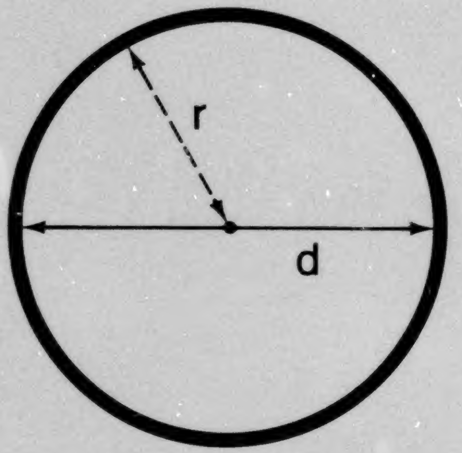
G	B	F	P	E	R	I	M	E	T	E	R	R	D	C	L
K	E	N	Q	Y	S	Z	V	O	L	U	M	E	J	I	I
T	O	O	F	C	I	B	U	C	B	F	K	T	Z	R	N
D	N	M	M	K	W	N	V	C	B	H	I	E	L	C	E
U	B	M	J	E	G	J	K	P	I	N	F	M	M	U	A
G	K	R	C	H	T	L	A	D	U	D	L	A	B	M	L
X	S	U	I	D	A	R	Q	C	R	H	L	I	C	F	Q
C	G	R	M	G	A	G	I	H	S	T	S	D	R	E	M
F	C	G	J	L	E	B	L	C	K	G	M	P	B	R	R
G	K	N	L	V	U	C	B	W	F	T	M	S	R	E	D
R	S	E	D	C	D	B	C	F	T	I	L	J	N	N	P
B	L	D	T	R	I	G	H	T	A	N	G	L	E	C	T
P	G	X	C	W	M	D	S	N	W	H	C	U	Q	E	P
W	A	E	R	A	D	P	G	B	F	C	D	H	R	L	N
C	L	S	W	R	T	R	G	V	Y	M	B	H	B	E	W
P	E	R	P	E	N	D	I	C	U	L	A	R	X	C	S

Area of a Parallelogram



Area = Length (L) × Width (W)

Area of a Circle



$$\text{Pi } (\pi) = 3.1416$$

$$\text{Radius } (r) = \frac{\text{Diameter } (d)}{2}$$

$$\text{Area of Circle} = \pi r^2$$

Ratio and Proportion

1:1:3 = Ratio of Cement, Lime, and Sand in Mortar Mix

0.5:0.5:1.5 = Proportion of Ratio 1:1:3 Cut in Half

BASIC MATH
UNIT I

INFORMATION SHEET

I. Terms and definitions

A. Whole number (integer) — Any of the natural numbers, both positive and negative, that represents a complete item

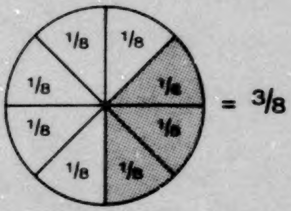
EXAMPLE: 25 is a whole number as opposed to $3/4$, a fraction or part of a whole.

B. Digit — Any one of the ten symbols, 0 to 9, by which all numbers can be expressed

C. Fraction — Part of a whole; represents one or more equal parts of a unit (Figure 1)

EXAMPLE:

FIGURE 1



D. Decimal — Fraction with an unwritten denominator of 10 or some power of 10; indicated with a point before the number

EXAMPLES: $0.1 = 1/10$
$0.06 = 6/100$
$0.003 = 3/1000$

E. Addition — Process of totaling two or more numbers to find another number called a sum

EXAMPLE: $3 + 5 + 9 = 17$

F. Subtraction — Opposite (inverse) operation of addition

EXAMPLE: $8 - 4 = 4$ as opposed to $4 + 4 = 8$

G. Multiplication — Abbreviated process of adding a number to itself a specified number of times

EXAMPLE: $6 \times 3 = 18$ as opposed to $6 + 6 + 6 = 18$

INFORMATION SHEET

H. Division — Opposite (inverse) operation of multiplication

EXAMPLE: 16 ÷ 2 = 8 as opposed to 8 × 2 = 16

I. Percent — One part in a hundred; reckoned on the basis of a whole divided into one hundred parts

J. Ratio — Relationship in quantity, amount, or size between two or more things

K. Proportional — Being relatively equal in size or quantity

EXAMPLE: 1:1:3 = 0.5:0.5:1.5

L. Nominal size — Theoretical size that may vary from the actual

EXAMPLE: A 2×4 stud is actually 1½ inches by 3½ inches.

M. Modular — Pertaining to nominal units based on a 4-inch module

N. Calculate — To solve by mathematical process

O. Problem — Mathematical proposition

II. Symbols used with math problems (Table 1)

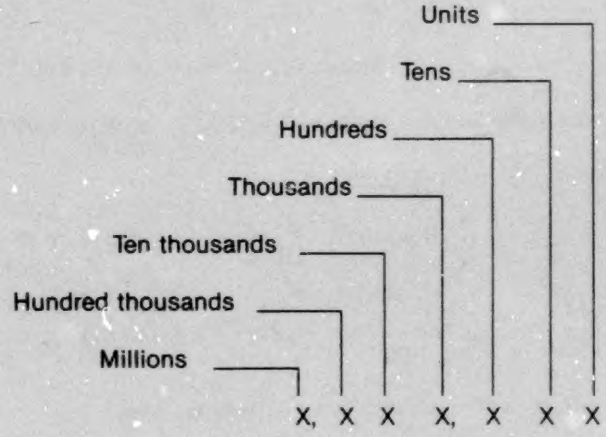
TABLE 1

Name of Symbol	Symbol
Plus sign (addition)	+
Minus sign (subtraction)	−
Times sign (multiplication)	×
Division sign	÷
Division frame	$\overline{)\quad}$
Equal sign	=
Decimal point	.
Percent symbol	%
Ratio symbol	:
Pi sign	π

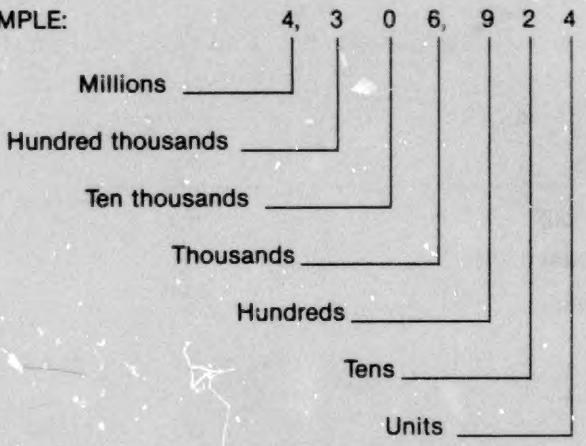
INFORMATION SHEET

III. Place values of a number

(NOTE: The position of a digit in a number shows how much that digit is worth. These positions are called *place values*.)


Units
Tens
Hundreds
Thousands
Ten thousands
Hundred thousands
Millions
X, X X X, X X X

EXAMPLE:


4, 3 0 6, 9 2 4
Millions
Hundred thousands
Ten thousands
Thousands
Hundreds
Tens
Units

(NOTE: The number in this example is four million, three hundred six thousand, nine hundred twenty-four.)

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IV. Adding whole numbers

A. Set up problem by writing units under units, tens under tens, and so on

EXAMPLE: Add the whole numbers 1632, 17, 550.

$$\begin{array}{r} 1632 \\ 17 \\ +\ 550 \\ \hline \end{array}$$

B. Add each column separately, beginning at top of units column

EXAMPLE:

$$\begin{array}{r} 1632 \\ 17 \\ +\ 550 \\ \hline 9 \end{array} \qquad \begin{array}{r} 1632 \\ 17 \\ +\ 550 \\ \hline 99 \end{array}$$

C. If the sum of any column is two or more digits, write the units digit in your answer and carrying the remaining digit(s) to the top of next column to the left

EXAMPLE:

$$\begin{array}{r} \\ 1632 \\ 17 \\ +\ 550 \\ \hline \rightarrow 199 \end{array} \qquad \begin{array}{r} 1 \leftarrow \\ 1632 \\ 17 \\ +\ 550 \\ \hline 199 \end{array}$$

Write units digit.

Carry remaining digit.

D. Add any carried digit(s) above the column with that column

EXAMPLE:

$$\begin{array}{r} 1 \\ 1632 \\ 17 \\ +\ 550 \\ \hline 2199 \end{array}$$

Carried Digit

V. Subtracting whole numbers

A. Set up problem by writing units under units, tens under tens, and so on

(NOTE: The top number in the problem [original number] is almost always larger than the bottom number [subtracted number].)

EXAMPLE: Subtract 91 from 123.

$$\begin{array}{rl} 123 & \text{Original Number} \\ -\ 91 & \text{Subtracted Number} \\ \hline \end{array}$$

B. Subtract each column separately, beginning at bottom of units column

EXAMPLE:

$$\begin{array}{r} 123 \\ -\ 91\uparrow \\ \hline 2 \end{array}$$

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C. If a digit in the subtracted number is larger than the digit above it, "borrow" 1 from the top digit in the next column to the left, decreasing that digit by one and increasing the digit being subtracted from by ten

EXAMPLE:

$$\begin{array}{r} \overset{0}{\cancel{1}}23 \\ -\ \ 91 \\ \hline 32 \end{array}$$

D. If there is nothing to borrow in the next left column (column contains a zero), first borrow for that column from its next left column

EXAMPLE:

$$\begin{array}{r} \overset{8}{\cancel{9}}\overset{10}{\cancel{0}}6 \\ -318 \\ \hline \end{array} \qquad \begin{array}{r} \overset{8}{\cancel{9}}\overset{\overset{9}{\cancel{10}}}{\cancel{0}}6 \\ -318 \\ \hline 8 \end{array} \qquad \begin{array}{r} \overset{8}{\cancel{9}}\overset{\overset{9}{\cancel{10}}}{\cancel{0}}6 \\ -318 \\ \hline 88 \end{array} \qquad \begin{array}{r} \overset{8}{\cancel{9}}\overset{\overset{9}{\cancel{10}}}{\cancel{0}}6 \\ -318 \\ \hline 588 \end{array}$$

E. Check your subtraction by adding your answer to the subtracted number

EXAMPLE: Problem / Check

$$\begin{array}{rl} 271 & \text{Original Number} \\ -164 & \text{Subtracted Number} \\ \hline 107 & \text{Answer} \end{array} \qquad \begin{array}{rl} 271 & \text{Original Number} \\ -164 & \\ \hline +\ 107 & \\ \hline 271 & \text{Check Answer} \end{array}$$

(NOTE: If you have solved the problem correctly, your check answer should be the same as the original number.)

VI. Multiplying whole numbers

A. Set up problem by writing the larger number (original number) above the smaller number (multiplier), writing units under units, tens under tens, and so on

(NOTE: You will get the correct answer [product] no matter which number is placed above the other, but the faster method places the larger above the smaller.)

EXAMPLE: Multiply the numbers 53 and 4.

$$\begin{array}{rl} 53 & \text{Original Number} \\ \underline{\times\ 4} & \text{Multiplier} \end{array}$$

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B. If the multiplier contains only one digit, multiply each digit in the original number by it, working from right to left

1. Multiply units digit in original number by multiplier

2. Write answer units digit and insert necessary carry digit above next left column in original number as required

EXAMPLE:

$$\begin{array}{r} 1 \\ 53 \\ \uparrow \\ \times\ \ 4 \\ \hline 2 \end{array}$$

3. Multiply tens digit by multiplier and add carried digit as required

EXAMPLE:

$$\begin{array}{r} 1 \\ 53 \\ \nwarrow \\ +\ \ 4 \\ \hline 212 \end{array}$$

C. If the multiplier contains more than one digit, find partial products

1. Multiply each digit in original number by each digit in multiplier, moving from right to left

2. Align partial products so that right-hand digit of each is directly under its corresponding digit in the multiplier

EXAMPLE: Multiply the numbers 174 and 42.

$$\begin{array}{r} \\ 174 \\ \uparrow \\ \times\ \ 42 \\ \hline 8 \\ \end{array} \qquad \begin{array}{r} 1 \\ 174 \\ \nwarrow \\ \times\ \ 42 \\ \hline 48 \\ \end{array} \qquad \begin{array}{r} 1 \\ 174 \\ \nwarrow \\ \times\ \ 42 \\ \hline 348 \\ \\ \uparrow \\ \text{First Partial} \\ \text{Product} \end{array} \qquad \begin{array}{r} 1 \\ 174 \\ \nearrow \\ \times\ \ 42 \\ \hline 348 \\ 6 \end{array} \qquad \begin{array}{r} 21 \\ 174 \\ \uparrow \\ \times\ \ 42 \\ \hline 348 \\ 96 \end{array} \qquad \begin{array}{r} 2 \\ 174 \\ \nwarrow \\ \times\ \ 42 \\ \hline 348 \\ 696 \\ \uparrow \\ \text{Second Partial} \\ \text{Product} \end{array}$$

D. Add the partial products

EXAMPLE:

$$\begin{array}{r} 174 \\ \times\ 42 \\ \hline 348 \\ +\ 696 \\ \hline 7308 \end{array} \quad \text{Answer (Product)}$$

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VII. Dividing whole numbers

A. Set up problem by writing original number (number to be divided) inside a division frame, and by writing divisor (number you are dividing by) outside frame

EXAMPLE: How many times will 33 go into 3347?

Divisor $33\overline{)3347}$ Original Number

B. Determine how many times the divisor will go into the first digit of the original number; if it will not, write a zero in the answer space directly above the first digit, and then determine how many times the divisor will go into the first two numbers of the original number

(NOTE: Continue trying to divide the original number by the divisor until a set of digits can be divided. Remember to write a zero each time the set of digits cannot be divided.)

EXAMPLE:

$$\begin{array}{r} \underline{0} \\ 34\overline{)3347} \end{array}$$

34 goes into 3 zero times.

$$\begin{array}{r} \underline{00} \\ 34\overline{)3347} \end{array}$$

34 goes into 33 zero times.

$$\begin{array}{r} \underline{009} \\ 34\overline{)3347} \end{array}$$

34 goes into 334 nine times.

C. Multiply the divisor by the answer (digit above frame); write this answer under the digit(s) that divisor went into, and subtract

EXAMPLE:

$$\begin{array}{r} 34 \\ \underline{\times\ 9} \\ 306 \end{array}$$

Multiply divisor (34) by answer (9).

$$\begin{array}{r} \underline{009} \\ 34\overline{)3347} \\ -\underline{306} \\ 28 \end{array}$$

Write answer under 334, the digits divisor went into, and subtract.

D. Bring down next unused digit from original number, and place it to the right of the subtracted difference (remainder)—even if the remainder is zero

EXAMPLE:

$$\begin{array}{r} \underline{009} \\ 34\overline{)3347} \\ \underline{306\downarrow} \\ 287 \end{array}$$

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E. Determine how many times the divisor will go into this new number; write your answer in the answer space above the digit that was brought down

```
EXAMPLE:      0098
           34)3347
              306
               287
```

F. Multiply the divisor by the last digit you wrote in the answer; write this product under the digits that divisor went into, and subtract

```
EXAMPLE:    34   Multiply divisor (34) by
           x 8   last digit of answer (8).
           272

              0098
           34)3347
              306    Write product under 287,
               287   the digits that divisor
             - 272   went into, and subtract.
                15
```

G. Continue this process until all numbers in the original number are used

H. Write any remaining subtracted difference as a remainder

```
EXAMPLE:      0098
           34)3347
              306
               287
               272
                15 Remainder
```

I. Check your answer by multiplying your answer times the divisor and adding the remainder to this number

(NOTE: If you have solved the problem correctly, your check answer should be the same as your original number.)

```
EXAMPLE:      98   Answer
             x34   Divisor
             392
            294
            3332
           +  15   Remainder
            3347   Check Answer (Same as original number)
```

INFORMATION SHEET

VIII. Types of fractions

A. Proper — Top number of fraction (numerator) is smaller than bottom number of fraction (denominator)

EXAMPLE: $\begin{matrix} 7 & \text{Numerator} \\ \overline{8} & \text{Denominator} \end{matrix}$

B. Improper — Top number of fraction (numerator) is larger than bottom number of fraction (denominator)

EXAMPLES: $\frac{9}{8}$ $\frac{16}{16}$

C. Mixed numbers — Contains a whole number and a proper fraction

EXAMPLES: $9\frac{1}{2}$, $1\frac{7}{8}$, $4\frac{3}{4}$

IX. Reducing fractions to lowest terms — Divide the numerator and denominator by the largest whole number that will go into each evenly

EXAMPLE: Reduce $\frac{4}{16}$ to its lowest terms.

$$\frac{4}{16} = \frac{4 \div 4}{16 \div 4} = \frac{1}{4}$$

(NOTE: The fraction $\frac{1}{4}$ is reduced to its lowest term because the numerator [1] and the denominator [4] cannot be divided by the same number.)

X. Converting mixed numbers to improper fractions

A. Multiply the whole number by the denominator of the fraction

EXAMPLE: Convert $4\frac{3}{8}$ to an improper fraction.

$8 \times 4 = 32$

B. Add your answer to the numerator

EXAMPLE: $32 + 3 = 35$

C. Place this sum over the original denominator

EXAMPLE: $\frac{35}{8}$ Improper Fraction

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XI. Convert improper fractions to mixed numbers

A. Divide the numerator by the denominator

EXAMPLE: Convert 18/15 to a mixed number.

$$\begin{array}{rl} 01 & \\ 15\overline{)18} & \\ \underline{15} & \\ 3 & \text{Remainder} \end{array}$$

B. Place the remainder over the denominator

EXAMPLE: $\dfrac{3}{15}$ $\begin{array}{l}\text{Remainder}\\ \text{Denominator}\end{array}$

C. Reduce this fraction if necessary

EXAMPLE: $\dfrac{3}{15} = \dfrac{3 \div 3}{15 \div 3} = \dfrac{1}{5}$

D. Add the reduced fraction to the whole number obtained by dividing the numerator by the denominator

EXAMPLE: $1 + \dfrac{1}{5} = 1\dfrac{1}{5}$ Mixed Number

XII. Adding fractions

A. Like fractions

(NOTE: Like fractions are those having the same, or common, denominators.)

EXAMPLES: 1/4 and 2/4, 5/8 and 5/8, 1/16 and 1/16

1. Add the numerators
2. Place sum of numerators over common denominator
3. Convert to mixed numbers and reduce as required

EXAMPLE 1: Add 1/4 and 2/4.

$$\frac{1}{4} + \frac{2}{4} = \frac{1+2}{4} = \frac{3}{4}$$

EXAMPLE 2: Add 5/8 and 5/8.

$$\frac{5}{8} + \frac{5}{8} = \frac{5+5}{8} = \frac{10}{8} = 10 \div 8 = 1\frac{2}{8} = 1\frac{1}{4}$$

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EXAMPLE 3: Add $^{1}/_{16}$ and $^{3}/_{16}$.

$$\frac{1}{16} + \frac{3}{16} = \frac{1 + 3}{16} = \frac{4}{16} = \frac{4 \div 4}{16 \div 4} = \frac{1}{4}$$

B. Unlike fractions

EXAMPLES: $^{11}/_{12}$ and $^{3}/_{9}$, $^{1}/_{8}$ and $^{3}/_{4}$

1. Change to like fractions

   a. Find the lowest number into which each denominator can be divided evenly (lowest common denominator)

   b. Multiply the numerators and denominators of each fraction by the number of times its denominator can be divided into the lowest common denominator

   EXAMPLE 1: Add $^{11}/_{12}$ and $^{3}/_{9}$.

   36 is lowest number into which both 12 and 9 can be divided evenly.

   $36 \div 12 = 3$

   $36 \div 9 = 4$

   $$\frac{11}{12} = \frac{11 \times 3}{12 \times 3} = \frac{33}{36}$$

   $$\frac{3}{9} = \frac{3 \times 4}{9 \times 4} = \frac{12}{36}$$

EXAMPLE 2: Add $^{1}/_{8}$ and $^{3}/_{4}$.

8 is the lowest number into which both 8 and 4 can be divided evenly.

$8 \div 8 = 1$

$8 \div 4 = 2$

$\frac{1}{8}$ remains as $^{1}/_{8}$ because 8 is the common denominator.

$$\frac{3}{4} = \frac{3 \times 2}{4 \times 2} = \frac{6}{8}$$

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2. Add as like fractions and reduce or convert to mixed numbers as required

EXAMPLE 1: Add $^{11}/_{12}$ and $^{3}/_{9}$.

$$\frac{11}{12} = \frac{33}{36} \text{ and } \frac{3}{9} = \frac{12}{36}$$

$$\frac{33}{36} + \frac{12}{36} = \frac{33 + 12}{36} = \frac{45}{36} = \frac{5}{4} = 1\frac{1}{4}$$

EXAMPLE 2: Add $^{1}/_{8}$ and $^{3}/_{4}$.

$$\frac{1}{8} \text{ remains } \frac{1}{8} \text{ and } \frac{3}{4} = \frac{6}{8}$$

$$\frac{1}{8} + \frac{6}{8} = \frac{1 + 6}{8} = \frac{7}{8}$$

C. Mixed numbers

1. Add whole numbers

2. Add fractions, first finding common denominators if necessary, and reduce or convert to mixed numbers as necessary

3. Add the sums of steps 1 and 2

EXAMPLE 1: Add $3^{1}/_{8}$ and $7^{3}/_{8}$.

$3 + 7 = 10$ Add whole numbers.

$\frac{1}{8} + \frac{3}{8} = \frac{1 + 3}{8} = \frac{4}{8} = \frac{1}{2}$ Add fractions and reduce.

$10 + \frac{1}{2} = 10\frac{1}{2}$ Add the sums of steps 1 and 2.

EXAMPLE 2: Add $4^{2}/_{3}$ and $1^{5}/_{6}$.

$4 + 1 = 5$ Add whole numbers.

$\frac{2}{3} + \frac{5}{6} = \frac{4}{6} + \frac{5}{6}$ Find common denominator.

$\frac{4}{6} + \frac{5}{6} = \frac{9}{6} = 1\frac{3}{6} = 1\frac{1}{2}$ Add fractions, convert to mixed number, and reduce.

$5 + 1\frac{1}{2} = 6\frac{1}{2}$ Add sums of steps 1 and 2.

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XIII. Subtracting fractions

A. Like fractions

1. Subtract smaller numerator from larger numerator

   EXAMPLE: Subtract $\frac{1}{16}$ from $\frac{7}{16}$.

   $7 - 1 = 6$

2. Place subtraction answer over common denominator

   EXAMPLE: $\frac{6}{16}$

3. Reduce to lowest terms as required

   EXAMPLE: $\frac{6}{16} = \frac{3}{8}$

B. Unlike fractions

1. Change to like fractions

   EXAMPLE: Subtract $\frac{1}{2}$ from $\frac{3}{4}$.

   $\frac{3}{4}$ remains the same because 4 is the common denominator.

   $\frac{1}{2} = \frac{1 \times 2}{2 \times 2} = \frac{2}{4}$

2. Subtract as for like fractions

   EXAMPLE: $\frac{3}{4} - \frac{2}{4} = \frac{3 - 2}{4} = \frac{1}{4}$

3. Reduce to lowest terms as required

C. Mixed numbers

1. Convert mixed numbers to like fractions

   EXAMPLE: Subtract $3\frac{1}{2}$ from $5\frac{1}{8}$.

   $5\frac{1}{8} - 3\frac{1}{2} =$

   $5\frac{1}{8} - 3\frac{4}{8}$

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2. Borrow a one from the original whole number if needed, convert the one to a like fraction, and add it to the smaller fraction

   (NOTE: This step is needed only if the like fraction in the original number is smaller than the like fraction in the subtracted number.)

   EXAMPLE: $5\frac{1}{8} - 3\frac{4}{8} = (4\frac{8}{8} + \frac{1}{8}) - 3\frac{4}{8}$

   $$= 4\frac{9}{8} - 3\frac{4}{8}$$

3. Subtract whole number from whole number and like fraction from like fraction

   EXAMPLE: $4\frac{9}{8} - 3\frac{4}{8} = 1\frac{5}{8}$

XIV. Multiplying fractions

A. Convert mixed numbers to improper fractions if necessary

B. Multiply numerators by numerators and denominators by denominators

C. Write the product of the numerators over the product of the denominators

D. Convert improper fractions to mixed numbers and reduce as required

EXAMPLE 1: Multiply 1/2 by 3/4.

$$\frac{1}{2} \times \frac{3}{4} = \frac{1 \times 3}{2 \times 4} = \frac{3}{8}$$

EXAMPLE 2: Multiply 1 1/4 by 1/2.

$1\frac{1}{4} = \frac{5}{4}$ Convert to improper fraction.

$$\frac{5}{4} \times \frac{1}{2} = \frac{5 \times 1}{4 \times 2} = \frac{5}{8}$$

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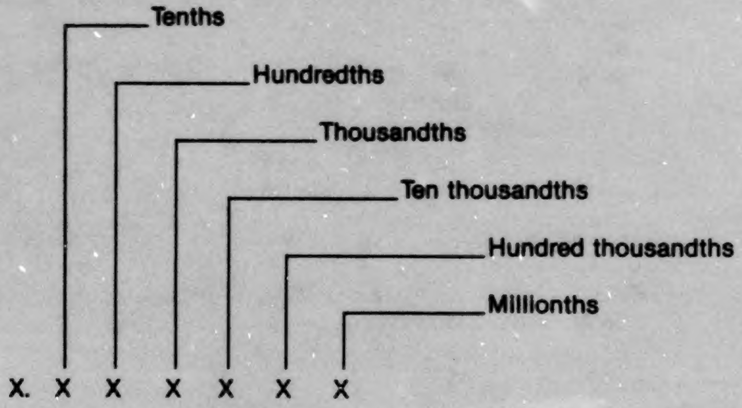
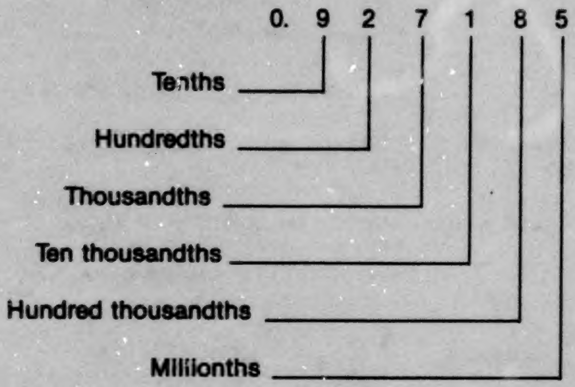
XV. Place values of decimal numbers


Tenths
Hundredths
Thousandths
Ten thousandths
Hundred thousandths
Millionths
X. X X X X X X

EXAMPLE:


0. 9 2 7 1 8 5
Tenths
Hundredths
Thousandths
Ten thousandths
Hundred thousandths
Millionths

(NOTE: The number in the example is read as nine hundred twenty-seven thousand, one hundred eighty-five millionths.)

XVI. Adding decimal numbers

A. Set up problem as for addition of whole numbers, aligning decimal points directly under each other

(NOTE: Zeros may be added to ensure that units line up under units, tens under tens, and so on. Whole numbers have an understood decimal point to the right of the units digit: 7 is 7., 75 is 75., and 754 is 754.)

EXAMPLE: Add 0.857, 2.1, 753, and 370.057.

$$\begin{array}{r} 0.857 \\ 2.1 \\ 753 \\ \underline{+\ 370.057} \end{array} \quad \text{or} \quad \begin{array}{r} 000.857 \\ 002.100 \\ 753.000 \\ \underline{+\ 370.057} \end{array}$$

B. Add each column of numbers as for whole numbers

C. Locate the decimal point in the answer by placing it directly under the decimal points above

EXAMPLE:

$$\begin{array}{rl} & 000.857 \\ & 002.100 \\ & 753.000 \\ + & 370.057 \\ \hline & 1126.014 \quad \text{Answer} \end{array}$$

XVII. Subtracting decimal numbers

A. Set up problem as for subtraction of whole numbers, aligning decimal points directly under each other

EXAMPLE: Subtract 1.397 from 8.120.

$$\begin{array}{rrl} & 8.120 & \text{Original Number} \\ - & 1.397 & \text{Subtracted Number} \\ \hline \end{array}$$

B. Subtract each column of numbers as for whole numbers

C. Locate the decimal point in the answer by placing it directly under the decimal points above

D. Check your subtraction by adding your answer to the subtracted number

(NOTE: If you have solved the problem correctly, your check answer should be the same as the original number.)

EXAMPLE:

$$\begin{array}{rrl} & 8.120 & \text{Original Number} \\ - & 1.397 & \text{Subtracted Number} \\ \hline + & 6.723 & \text{Answer (Difference)} \\ \hline & 8.120 & \text{Check Answer} \end{array}$$

XVIII. Multiplying decimal numbers

A. Set up problem and multiply as for multiplication of whole numbers

(NOTE: Do *not* align the decimal points in columns when setting up multiplication problems for decimal numbers.)

EXAMPLE: Multiply 27.935 by 7.07.

$$\begin{array}{rrl} & 27.935 & \text{Original Number} \\ \times & 7.07 & \text{Multiplier} \\ \hline & 195545 & \\ & 1955450 & \\ \hline & 19750045 & \end{array}$$

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B. Add the number of decimal places to the right of the decimal points in the multiplier and original number

EXAMPLE:	27.935	3	Decimal Places
	× 7.07	+2	Decimal Places
		5	Total Decimal Places

C. Locate decimal point in answer by beginning at far right digit and counting off as many places to the left as the total decimal places found in step B

EXAMPLE:

$$\begin{array}{r l} 27.935 & \\ \underline{\times\ \ 7.07} & \\ 195545 & \\ \underline{1955450} & \\ 197.50045 & \quad \text{5 Decimal Places} \end{array}$$

XIX. Dividing decimal numbers

A. Set up problem as for division of whole numbers

EXAMPLE: Divide 0.25 by 0.005.

Divisor $0.005\overline{)0.25}$ Original Number

B. Move the decimal point in the divisor to the right of the far right digit in the divisor

EXAMPLE: $0.\underset{\curvearrowright}{005}.\overline{)0.25}$

C. Move the decimal point in the original number to the right by the same number of decimal places that you moved the decimal point in the divisor, adding zeros to the original number if necessary

EXAMPLE: $0.\underset{\curvearrowright}{005}.\overline{)0.\underset{\curvearrowright}{250}.}$

(NOTE: If you are dividing a decimal number into a whole number, remember that whole numbers have an understood decimal point to the right of the units digit.)

EXAMPLE: $0.03\overline{)9}$ becomes $0.\underset{\curvearrowright}{03}.\overline{)9.\underset{\curvearrowright}{00}.}$

D. Place a decimal point in the answer space directly above the repositioned decimal point in the original number

EXAMPLE: $0.\underset{\curvearrowright}{005}.\overline{)0.\underset{\curvearrowright}{250}.}\overset{\longleftarrow}{}$

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E. Divide as for whole numbers

EXAMPLE:
$$\begin{array}{rr} & 50. \\ 0005. & \overline{)0250.} \\ & \underline{025} \\ & 00 \end{array}$$

F. Check your division by multiplying the original divisor (before decimal point was moved) by your answer and adding any remainder to this number

(NOTE: If you have solved the problem correctly, your check answer should be the same as the original number.)

EXAMPLE:

0.005	Divisor
× 50	Answer
0.250	Check Answer (Same as original number)

XX. Converting fractions to decimals and percentages

A. Fractions to decimals — Divide the numerator by the denominator

EXAMPLE: Convert $^5/_8$ to a decimal.

5	Numerator
8	Denominator

$$\begin{array}{rr} & 0.625 \\ 8 & \overline{)5.000} \\ & \underline{4\,8} \\ & 20 \\ & \underline{16} \\ & 40 \\ & \underline{40} \\ & 0 \end{array}$$

B. Fractions to percentages

(NOTE: Percent means that a number is a fraction of 100.)

1. Convert the fractions to decimals by dividing numerator by denominator
2. Move the decimal point in the answer two places to the right
3. Place the percent symbol after the number

EXAMPLE: Convert $^7/_{33}$ to a percentage.

7	Numerator
33	Denominator

$$\begin{array}{rr} & 0.2121 = 21.21\% \\ 33 & \overline{)7.0000} \\ & \underline{6\,6} \\ & 40 \\ & \underline{33} \\ & 70 \\ & \underline{66} \\ & 40 \\ & \underline{33} \\ & 7 \end{array}$$

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XXI. Decimal and fractional equivalents

1/64	.015625	33/64	.515625
1/32	.03125	17/32	.53125
3/64	.046875	35/64	.546875
1/16	.0625	9/16	.5625
5/64	.078125	37/64	.578125
3/32	.09375	19/32	.59375
7/64	.109375	39/64	.609375
1/8	**.125**	5/8	**.625**
9/64	.140625	41/64	.640625
5/32	.15625	21/32	.65625
11/64	.171875	43/64	.671875
3/16	.1875	11/16	.6875
13/64	.203125	45/64	.703125
7/32	.21875	23/32	.71875
15/64	.234375	47/64	.734375
1/4	**.25**	3/4	**.75**
17/64	.265625	49/64	.765625
9/32	.28125	25/32	.78125
19/64	.296875	51/64	.796875
5/16	.3125	13/16	.8125
21/64	.328125	53/64	.828125
11/32	.34375	27/32	.84375
23/64	.359375	55/64	.859375
3/8	**.375**	7/8	**.875**
25/64	.390625	57/64	.890625
13/32	.40625	29/32	.90625
27/64	.421875	59/64	.921875
7/16	.4375	15/16	.9375
29/64	.453125	61/64	.953125
15/32	.46875	31/32	.96875
31/64	.484375	63/64	.984375
1/2	**.5**	1	**.1**

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XXII. Converting percentages to fractions and decimal numbers

A. Percentages to fractions

1. Drop the percent symbol
2. Place the number over 100
3. Reduce to lowest terms if necessary

EXAMPLE: Convert 38% to a fraction.

$$38\% = 38$$
$$= \frac{38}{100}$$
$$= \frac{19}{50}$$

B. Percentages to decimals

1. Drop the percent symbol
2. Move decimal point two places to left

EXAMPLE: Convert 74% to a decimal.

$$74\% = 74$$
$$= 0.74$$

XXIII. Solving percentage problems

(NOTE: Percentage problems may involve solving for the percent ["16 is what percent of 80?"], the part ["What number is 20% of 80?"], or the whole ["16 is 20% of what number?"].)

A. Write the unknown as "X"

EXAMPLE: 16 is what percent of 80?

16 is X percent of 80.

(NOTE: The unknown may be the percent, the part, or the whole.)

B. Write the percent (known or unknown) as a fraction with a denominator of 100

EXAMPLE: 16 is $\frac{X}{100}$ percent of 80.

C. Write the part and the whole as a fraction, writing the part as the numerator and the whole as the denominator

EXAMPLE: $\frac{16}{80}$ $\frac{\text{Part}}{\text{Whole}}$

D. Set up the equation by writing the two fractions with an equal sign between them

EXAMPLE: $\frac{X}{100} = \frac{16}{80}$

E. Solve the equation by multiplying the numerator of each fraction by the denominator of the other

(NOTE: This process is known as *cross multiplying*.)

EXAMPLE: $\frac{X}{100} = \frac{16}{80}$

$80X = 1600$

F. Divide each side of the equation by the multiplier of X

EXAMPLE: $80X = 1600$

$X = 20\%$

16 is 20% of 80.

XXIV. Terms used in geometry

A. Geometric figure — Shape formed by straight or curved lines

B. Perimeter — Outer limits or boundary

C. Lineal — Relating to, consisting of, or resembling a straight line

D. Parallel — Extending in the same direction; equal distance apart and never meeting (Figure 2)

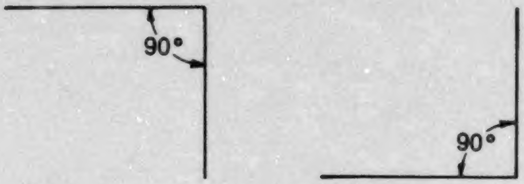
EXAMPLE:

FIGURE 2

E. Right angle — Angle formed by two lines perpendicular to each other; 90-degree angle (Figure 3)

EXAMPLE:

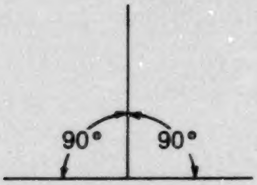
FIGURE 3



F. Perpendicular — Line or surface at right angle to another line or surface (Figure 4)

EXAMPLE:

FIGURE 4



G. Radius — Line from center of a circle to any point on edge of circle (Figure 5)

EXAMPLE:

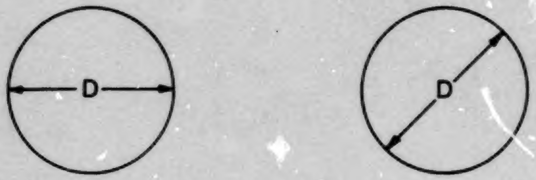
FIGURE 5

INFORMATION SHEET

H. Diameter — Distance between outer edges of a circle through center point (Figure 6)

EXAMPLE:

FIGURE 6



I. Circumference — Distance around outer edge of a circle

J. Pi — Greek letter (π) representing ratio of a circle's circumference to its diameter; ratio approximately 3.1416

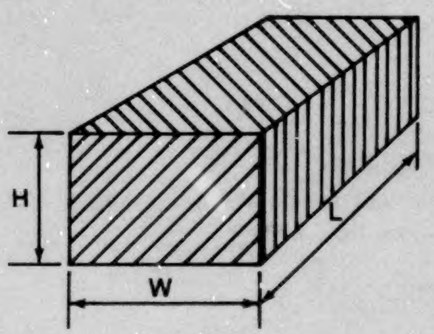
K. Area — Measure of a flat surface; expressed in square units

EXAMPLE: W × L = Area in square units

L. Volume — Space occupied by a body; expressed in cubic units (Figure 7)

EXAMPLE:

FIGURE 7



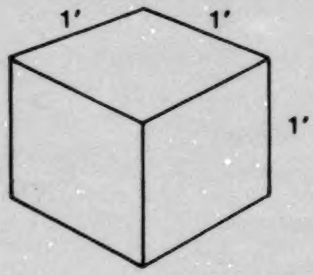
M. Cubic unit — Unit with three equal dimensions including length, width, and height

INFORMATION SHEET

N. Cubic foot — Volume of an object that is 1 foot long, 1 foot wide, and 1 foot high (Figure 8)

EXAMPLE:

FIGURE 8

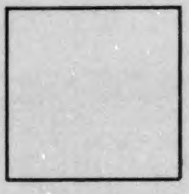


XXV. Types of geometric figures (Figures 9-15)

A. Square — Figure having four sides of equal length and four right angles

EXAMPLE:

FIGURE 9



B. Rectangle — Figure with two parallel ends of equal length, two parallel sides of equal length, and four right angles

EXAMPLE:

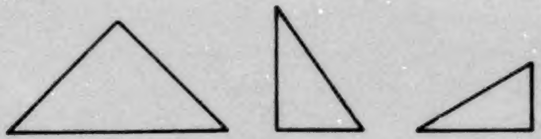
FIGURE 10

INFORMATION SHEET

C. Triangle — Figure having three sides and three angles

EXAMPLES:

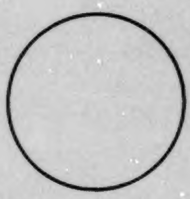
FIGURE 11



D. Circle — Flat, round figure formed by one curved line; all points of curved line are equidistant from center point

EXAMPLE:

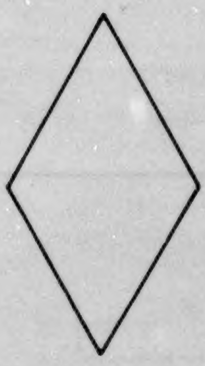
FIGURE 12



E. Rhombus — Figure having no right angles and four sides of equal length

EXAMPLE:

FIGURE 13

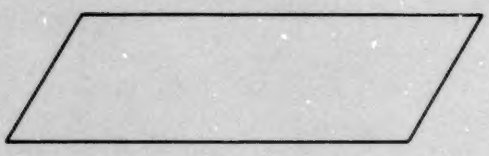


INFORMATION SHEET

F. Parallelogram — Figure such as a square, rectangle, or rhombus with two parallel ends of equal length and two parallel sides of equal length

EXAMPLE:

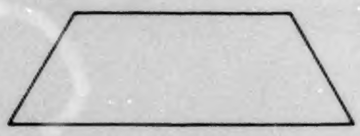
FIGURE 14



G. Trapezoid — Figure with only one pair of parallel opposite sides

EXAMPLE:

FIGURE 15



XXVI. Units of measure and their equivalents

A. Inch (") — Equal to one-twelfth of a foot ($^1/_{12}$′) or one thirty-sixth of a yard ($^1/_{36}$ yard)

B. Foot (′) — Equal to twelve inches (12") or one-third of a yard ($^1/_3$ yard)

C. Yard — Equal to three feet (3′) or thirty-six inches (36")

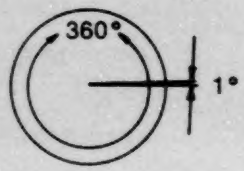
D. Rod — Equal to sixteen and one-half feet (16$^1/_2$′)

E. Mile — Equal to five thousand, two hundred and eighty feet (5280′)

F. Degree (°) — Equal to $^1/_{360}$ of a circle (Figure 16)

EXAMPLE:

FIGURE 16



INFORMATION SHEET

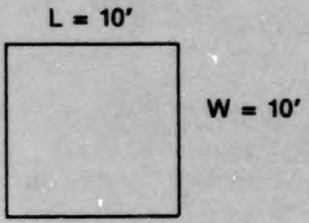
XXVII. Calculating area of geometric figures (Figures 17-22)

(NOTE: Area is always labeled in square units of measure.)

A. Square — Use the formula Area = Length × Width or $A = LW$

EXAMPLE:

FIGURE 17



$A = LW$

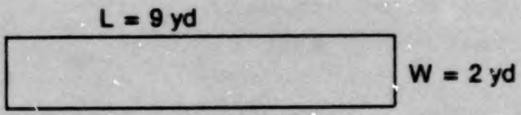
$= 10 \times 10$

$= 100$ square feet

B. Rectangle — Use the formula Area = Length × Width or $A = LW$

EXAMPLE:

FIGURE 18



$A = LW$

$= 9 \times 2$

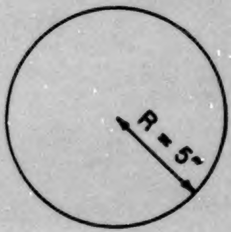
$= 18$ square yards

C. Circle — Use the formula Area = πr^2 (radius × radius)

(NOTE: Pi [π] is 3.14, which is the circumference of a circle divided by the diameter of the circle.)

EXAMPLE:

FIGURE 19



$A = \pi r^2$

$= 3.14 \times (5 \times 5)$

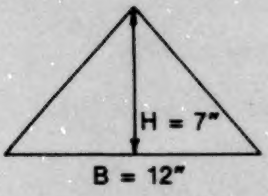
$= 78.50$ square inches

INFORMATION SHEET

D. Triangle — Use the formula Area = $\frac{1}{2}$ Base × Height, or $A = \frac{1}{2}BH$

EXAMPLE:

FIGURE 20

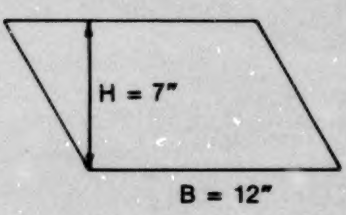


$$\begin{aligned} A &= \frac{1}{2}BH \\ &= \left(\frac{1}{2} \times 12\right) \times 7 \\ &= 6 \times 7 \\ &= 42 \text{ square inches} \end{aligned}$$

E. Parallelogram — Use the formula Area = Base × Height, or $A = BH$

EXAMPLE:

FIGURE 21

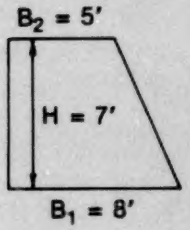


$$\begin{aligned} A &= BH \\ &= 12 \times 7 \\ &= 84 \text{ square inches} \end{aligned}$$

F. Trapezoid — Use the formula Area = $\frac{1}{2}H(B_1 + B_2)$

EXAMPLE:

FIGURE 22



$$\begin{aligned} A &= \frac{1}{2}H(B_1 + B_2) \\ &= \left(\frac{1}{2} \times 7\right) \times (8 + 5) \\ &= \frac{7}{2} \times 13 \\ &= \frac{7}{2} \times \frac{13}{1} \\ &= \frac{91}{2} \\ &= 45\frac{1}{2} \text{ square feet} \end{aligned}$$

INFORMATION SHEET

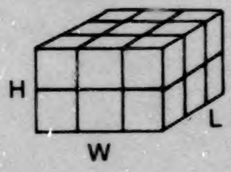
XXVIII. Calculating volume of solid figures

(NOTE: Volume is always measured in cubic units.)

A. Using counting method — Use formula Cubic Units = Number of Cubes in Layer × Number of Layers (Figure 23)

EXAMPLE:

FIGURE 23



Cubic Units = Number of Cubes in Layer × Number of Layers

= 9 × 2

= 18 cubes

B. Using formula and converting as necessary

1. Using formula Volume = Length × Width × Height or V = LWH

EXAMPLE 1: Where L = 3 feet, W = $\frac{1}{2}$ foot, and H = $1\frac{1}{2}$ feet

$$V = LWH$$

$$= 3 \times \frac{1}{2} \times 1\frac{1}{2}$$

$$= \frac{9}{4} \text{ or } 2\frac{1}{4} \text{ cubic feet}$$

EXAMPLE 2: Where L = 10 feet, W = 8 feet, and H = 3 feet

$$V = LWH$$

$$= 10 \times 8 \times 3$$

$$= 240 \text{ cubic feet}$$

2. Converting using formula

$$\text{Cubic Yards} = \frac{\text{Width in Feet} \times \text{Length in Feet} \times \text{Thickness in Feet}}{27}$$

INFORMATION SHEET

(NOTE: The formula for converting will differ, depending on the units being converted. The formula for cubic yards is given in the example because it is the conversion most often used by carpenters. Because given measurements are usually in feet and inches, thickness in inches must be broken down by using fractions or decimals.)

EXAMPLE 1: Converting to yards, using fractions where width = 30′, length = 60′, and thickness = 4″

$$\text{Cubic Yards} = \frac{\text{Width in Feet} \times \text{Length in Feet} \times \text{Thickness in Feet}}{27}$$

$$= \frac{30' \times 60' \times 4''}{27}$$

$$= \frac{30' \times 60' \times \tfrac{1}{3}'}{27}$$

$$= 22.22 \text{ cubic yards}$$

EXAMPLE 2: Converting to yards, using decimals where width = 30′, length = 60′, and thickness = 4″

$$\text{Cubic Yards} = \frac{\text{Width in Feet} \times \text{Length in Feet} \times \text{Thickness in Feet}}{27}$$

$$= \frac{30' \times 60' \times .33'}{27}$$

$$= \frac{594}{27}$$

$$= 22 \text{ cubic yards}$$

XXIX. Solving ratio and proportion problems — To increase or decrease proportionally, multiply or divide each number in the ratio by the same number

(NOTE: Ratio indicates parts of material per mix; proportion indicates that the ratio is the same but the quantity may differ.)

EXAMPLE 1: You want to find half of the ratio 1:1:3.

Divide each number in the ratio by 2 to get 0.5:0.5:1.5.

EXAMPLE 2: You need three times the ratio 1:1:3.

Multiply each number in the ratio by 3 to get 3:3:9.

BASIC MATH
UNIT I

ASSIGNMENT SHEET #1 — ADD WHOLE NUMBERS

NAME ________________________________ SCORE ______________

Like most people, you probably use addition every day. For example, today you probably added coins together to pay for sodas and snacks. Every time you add, you use basic addition facts. The following exercises will form part of your carpentry math background and serve as a basis for completing other exercises and problems.

EXAMPLES:

$$\begin{array}{r} 5 \\ +\ 10 \\ \hline 15 \end{array} \qquad \begin{array}{rl} 1 & \leftarrow \text{Carried Digit} \\ 67 & \\ +\ 25 & \\ \hline 92 & \end{array} \qquad \begin{array}{rl} 1\,1 & \leftarrow \text{Carried Digits} \\ 539 & \\ 333 & \\ +\ 432 & \\ \hline 1304 & \end{array}$$

PART I

Solve each of the following addition problems. Refer to Information Sheet, Section IV if necessary, and show your work.

A. $\begin{array}{r} 2 \\ +\ 9 \\ \hline \end{array}$ B. $\begin{array}{r} 8 \\ +\ 8 \\ \hline \end{array}$ C. $\begin{array}{r} 7 \\ +\ 6 \\ \hline \end{array}$ D. $\begin{array}{r} 15 \\ +\ 8 \\ \hline \end{array}$ E. $\begin{array}{r} 81 \\ +\ 27 \\ \hline \end{array}$

F. $\begin{array}{r} 7 \\ 38 \\ +\ 43 \\ \hline \end{array}$ G. $\begin{array}{r} 55 \\ 88 \\ +\ 99 \\ \hline \end{array}$ H. $\begin{array}{r} 341 \\ 428 \\ +\ 769 \\ \hline \end{array}$ I. $\begin{array}{r} 472 \\ 564 \\ +\ 881 \\ \hline \end{array}$ J. $\begin{array}{r} 9876 \\ 5432 \\ +\ 1122 \\ \hline \end{array}$

PART II

A. If a carpenter used 330 lineal feet of two-by-four on one wall, 570 lineal feet on another, and 275 on another, how many lineal feet were used?

Total lineal feet = ____________

B. A contractor ordered the following number of doors at different dates: 256, 62, 575, and 242. How many doors should he be billed for?

Total doors = ____________

ASSIGNMENT SHEET #1

C. If a contractor paid $480 for doors, $13 for trim, $81 for hardware, and $35 for shelving, what was the total cost of the materials?

Total cost of materials = $____________

D. If it takes 1135 square feet of flooring for the first apartment, 1225 square feet for the second, 1220 square feet for the third, 1125 square feet for the fourth, and 7425 square feet for the last apartment, what would be the total square feet of flooring needed?

Total square feet = ____________

BASIC MATH
UNIT I

ASSIGNMENT SHEET #2 — SUBTRACT WHOLE NUMBERS

NAME ______________________________ SCORE ______________

Addition is the first fundamental operation in mathematics. Subtraction, the opposite of addition, is the process of finding the difference between two numbers. It is the second fundamental operation. You can check the accuracy of the answer obtained in a subtraction problem by simply adding the difference to the subtracted number. The sum of these two numbers will equal the original number if the answer is correct.

EXAMPLES:

$$\begin{array}{rl} 12 & \text{Original Number} \\ \underline{-\ 7} & \text{Subtracted Number} \\ \underline{+\ 5} & \text{Answer (Difference)} \\ 12 & \text{Check Answer} \\ & \text{(Same as original number)} \end{array} \qquad \begin{array}{rl} 57 & \text{Original Number} \\ \underline{-\ 35} & \text{Subtracted Number} \\ \underline{+\ 22} & \text{Answer (Difference)} \\ 57 & \text{Check Answer} \end{array}$$

PART I

Solve each of the following subtraction problems. Check your answers by adding the difference to the subtracted number. Refer to Information Sheet, Section V if necessary, and show your work.

A. $\begin{array}{r} 9 \\ \underline{-\ 5} \end{array}$ B. $\begin{array}{r} 15 \\ \underline{-\ 8} \end{array}$ C. $\begin{array}{r} 75 \\ \underline{-\ 22} \end{array}$ D. $\begin{array}{r} 453 \\ \underline{-\ 47} \end{array}$ E. $\begin{array}{r} 742 \\ \underline{-\ 318} \end{array}$

F. $\begin{array}{r} 981 \\ \underline{-\ 698} \end{array}$ G. $\begin{array}{r} 1420 \\ \underline{-\ 245} \end{array}$ H. $\begin{array}{r} 3459 \\ \underline{-\ 1649} \end{array}$ I. $\begin{array}{r} 55722 \\ \underline{-\ 4272} \end{array}$ J. $\begin{array}{r} 98679 \\ \underline{-\ 8957} \end{array}$

PART II

A. If a wall takes 172 studs and you have 46, how many more studs would you need for the job?

Number of studs = ____________

ASSIGNMENT SHEET #2

B. If you have 542 square feet of plywood and it takes 1702 square feet of plywood to complete the job, how many more square feet will you need?

Number of square feet needed = ____________

C. You have 6520 square feet of flooring to replace on a remodeling job. You have 470 square feet left over from another job and 1640 square feet in your warehouse. How many more square feet will you need to complete the job?

Number of square feet needed = ____________

D. A carpenter ordered 48,000 wall studs. Of these, he used 4,850 on one job, 12,720 on another job, and 16,285 on another job. How many studs did he have left?

Number of studs left = ____________

BASIC MATH
UNIT I

ASSIGNMENT SHEET #3 — MULTIPLY WHOLE NUMBERS

NAME ______________________________________ SCORE ________________

Multiplication is the third basic operation in mathematics. It is a shortcut method of adding. For example, if you correctly add twelve 12s, the result will be 144, the same as 12 multiplied by 12. Some multiplication problems involve carrying. You may write down the carried digits, or simply remember them. Use the method that works best for you.

When multiplying by numbers that contain two or more digits, you must be careful to align the partial products properly. Write the right-hand digit of each partial product directly below the multiplying digit. This causes the partial products to be properly aligned so that tens will be added to tens, hundreds to hundreds, and so on.

EXAMPLES:

$$\begin{array}{r} 8 \\ \times\ 7 \\ \hline 56 \end{array} \qquad \begin{array}{rl} 1 & \leftarrow \text{Carried Digit} \\ 53 & \\ \times\ 4 & \\ \hline 212 & \end{array} \qquad \begin{array}{rl} 11 & \leftarrow \text{Carried Digits} \\ 756 & \\ \times\ 312 & \\ \hline 1512 & \leftarrow \text{First Partial Product} \\ 756 & \leftarrow \text{Second Partial Product} \\ 2268 & \leftarrow \text{Third Partial Product} \\ \hline 235872 & \leftarrow \text{Product} \end{array}$$

PART I

Solve each of the following multiplication problems. Refer to Information Sheet, Section VI if necessary, and show your work.

A. $\begin{array}{r} 6 \\ \times\ 7 \\ \hline \end{array}$ B. $\begin{array}{r} 9 \\ \times\ 8 \\ \hline \end{array}$ C. $\begin{array}{r} 54 \\ \times\ 6 \\ \hline \end{array}$ D. $\begin{array}{r} 721 \\ \times\ 4 \\ \hline \end{array}$ E. $\begin{array}{r} 1682 \\ \times\ 5 \\ \hline \end{array}$

F. $\begin{array}{r} 78 \\ \times\ 26 \\ \hline \end{array}$ G. $\begin{array}{r} 453 \\ \times\ 47 \\ \hline \end{array}$ H. $\begin{array}{r} 314 \\ \times\ 527 \\ \hline \end{array}$ I. $\begin{array}{r} 2143 \\ \times\ 235 \\ \hline \end{array}$ J. $\begin{array}{r} 4123 \\ \times\ 1324 \\ \hline \end{array}$

ASSIGNMENT SHEET #3

PART II

A. If one load of top soil weighs 9,769 pounds, how much would 7 loads weigh?

Weight = ____________

B. If a carpenter can nail an average of 170 square feet of siding per hour, how many square feet can he nail in 48 hours?

Number of square feet = ____________

C. Six carpenters lay an average of 950 square feet of roofing per person per day. What will be their average for 3 days' work?

Average = ____________

D. Figure the amount of time worked in 4 weeks by 12 carpenters who work 30 hours each week.

Hours worked = ____________

BASIC MATH
UNIT I

ASSIGNMENT SHEET #4 — DIVIDE WHOLE NUMBERS

NAME ______________________________ SCORE ______________

Carpenters use division in many aspects of their work. Windows, cabinets, stairs, and other construction features are often installed in sets of the same size units. By dividing the space allowed for such structures by the size of the individual units, the carpenter can determine the number of units required. Division is also used to compute costs and expenses and in making estimates.

Division is the fourth and last basic operation in mathematics. Multiplication puts together—division takes apart. Division is the reverse of multiplication. Long division is the name used for division by numbers that cannot readily be used as simple dividers. Division answers are checked by multiplying the divisor by the answer and adding the remainder.

EXAMPLES:

$$\begin{array}{r} \text{Answer} \\ \text{Divisor}\,\overline{)\text{Original Number}} \end{array} \qquad \begin{array}{r} 324 \\ 3\,\overline{)972} \\ \underline{9} \\ 7 \\ \underline{6} \\ 12 \\ \underline{12} \end{array}$$

$$\begin{array}{rl} 0111 & \text{Answer} \\ 51\,\overline{)5678} & \\ \underline{51} & \\ 57 & \\ \underline{51} & \\ 68 & \\ \underline{51} & \\ 17 & \text{Remainder} \end{array} \qquad \text{Check:} \quad \begin{array}{rl} 111 & \text{Answer} \\ \underline{\times\ 51} & \text{Divisor} \\ 111 & \\ \underline{555} & \\ 5661 & \\ \underline{+\ 17} & \text{Remainder} \\ 5678 & \text{Original Number} \end{array}$$

PART I

Solve each of the following division problems. Check your answers by multiplying the divisor by the original number. Refer to Information Sheet, Section VII if necessary, and show your work.

A. $2\overline{)8}$ B. $6\overline{)48}$ C. $9\overline{)819}$ D. $4\overline{)1248}$ E. $13\overline{)39}$

ASSIGNMENT SHEET #4

F. $66\overline{)198}$ G. $84\overline{)5212}$ H. $124\overline{)345}$ I. $464\overline{)829}$ J. $746\overline{)2872}$

PART II

A. Four carpenters working together laid 8280 square feet of flooring in one day. What was the average number of square feet laid by each carpenter that day?

Average square feet = ____________________

B. A home buyer has requested that one wall of a dining room be done in 1-foot-by-4-foot windows. How many windows can be installed if the wall is 108 inches long and the windows, with connecting mulls, are 13 inches wide? How much space will be left?

Number of windows installed = ____________________

Amount of space left = ____________________

C. A contractor built 26 houses in an addition. The project required 2535 board feet of white pine. How much white pine was required on the average per house?

Number of board feet of white pine = ____________________

D. A sheet of 4-foot-by-8-foot plywood is 32 square feet. How many sheets of plywood would be required to deck a roof area of 2176 square feet if no allowance is made for waste?

Number of sheets of plywood = ____________________

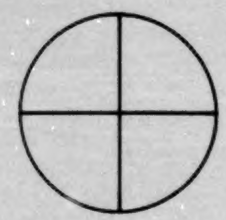
BASIC MATH
UNIT I

ASSIGNMENT SHEET #5 — WORK WITH FRACTIONS

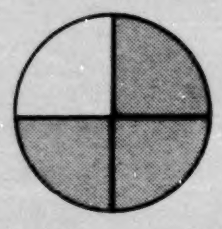
NAME ______________________________ SCORE ____________

Fractions are essential to the carpentry trade. Not only does the carpenter frequently use fractions for measurements, but much of the material used in the trade is sized by fractional units. Plywood and drywall come in sizes $\frac{1}{2}$- and $\frac{5}{8}$-inch thick. Even lumber that is referred to in even numbers is actually measured in fractional inches. For example, a two-by-four board is actually $1\frac{1}{2}$ inches x $3\frac{1}{2}$ inches. This frequent use of fractions in the trade makes it necessary for the good carpenter to understand thoroughly how to work with fractions.

When something is divided into parts that are all the same size, or of equal size, it is divided into fractional parts. For example, the circle below is divided into four fractional parts.



To talk about fractional parts, you use fractions. For example, one of the four parts of the circle below is unshaded, or $\frac{1}{4}$ of the circle is unshaded; three of the four parts of the circle are shaded, or $\frac{3}{4}$ of the circle is shaded.



In the fraction $\frac{3}{4}$, the 4 is called the denominator. It shows the number of equal parts into which the circle is divided. The 3 is called the numerator. It shows the number of parts that are used.

PART I

A. Identify the numerator and denominator of each of the following fractions by filling in the blanks. Refer to Information Sheet, Section VIII if necessary.

1. In the fraction $\frac{5}{8}$, the numerator is ______ and the denominator is ______.

ASSIGNMENT SHEET #5

2. In the fraction 7/16, 7 is the ______________________________ and 16 is the ______________________________.

3. In the fraction 1/4, what is the numerator? ______ denominator? ______

B. Write the fractions that fit the following statements.

____________________1. A fraction with a denominator of 16 and a numerator of 10.

____________________2. A fraction with a numerator of 16 and a denominator of 32.

C. A carpenter cuts a piece of plywood into 8 equal pieces and then uses 1 of the 8 pieces.

____________________1. Which number represents the numerator?

____________________2. Which number represents the denominator?

____________________3. What fractional part of the plywood did the carpenter use?

PART II

A. Match the shaded portions of the following figures to the fractions they represent. Write the correct letters in the blanks.

_____ 1. 4/8

_____ 2. 2/2

_____ 3. 6/16

_____ 4. 3/8

_____ 5. 5/8

_____ 6. 1/2

_____ 7. 7/16

_____ 8. 3/4

_____ 9. 1/4

_____10. 1/8

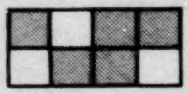
_____11. 7/8

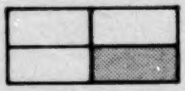
_____12. 2/4

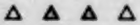
_____13. 2/8

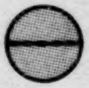
_____14. 13/16

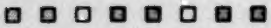
_____15. 6/8

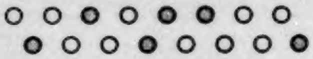
a. 

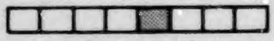
b. 

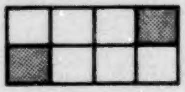
c. 

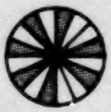
d. 

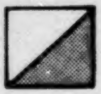
e. 

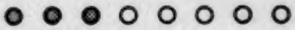
f. 

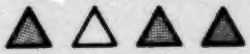
g. 

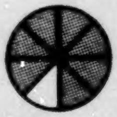
h. 

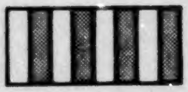
i. 

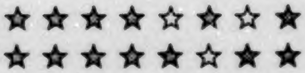
j. 

k. 

l. 

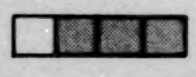
m. 

n. 

o. 

ASSIGNMENT SHEET #5

B. Draw a figure shaded to represent each of the following fractions.

EXAMPLE: 3/4 

1. 1/2

6. 5/16

2. 3/4

7. 2/8

3. 5/8

8. 3/16

4. 1/4

9. 3/8

5. 7/8

10. 13/16

BASIC MATH
UNIT I

ASSIGNMENT SHEET #6 — REDUCE FRACTIONS TO LOWEST TERMS

NAME ______________________________ SCORE ____________

Fractions are "reduced" to their lowest terms so that they are more readily understood or recognized. For example, 1/2 is more easily recognized than 16/32.

To reduce a fraction to its lowest terms, divide the numerator and the denominator by the largest whole number that will go into both evenly.

EXAMPLES: $\frac{9}{12} = \frac{9 \div 3}{12 \div 3} = \frac{3}{4}$ $\qquad$ $\frac{12}{32} = \frac{12 \div 4}{32 \div 4} = \frac{3}{8}$

Reduce the following fractions to their lowest terms. Refer to Information Sheet, Section IX if necessary.

A. 4/8 = ______

F. 9/24 = ______

B. 8/16 = ______

G. 16/32 = ______

C. 2/2 = ______

H. 2/4 = ______

D. 4/16 = ______

I. 9/12 = ______

E. 12/48 = ______

J. 50/100 = ______

BASIC MATH
UNIT I

ASSIGNMENT SHEET #7 — CONVERT UNLIKE FRACTIONS TO LIKE FRACTIONS

NAME ______________________________ SCORE ______________

Fractions must have common denominators if they are to be added or subtracted. Fractions that have the same denominator are said to have a *common* denominator and to be *like fractions*. The easiest way to find a common denominator for two fractions is to multiply the numerator and the denominator of each fraction by the denominator of the other fraction.

EXAMPLE: Find a common denominator for the fractions $^{1}/_{4}$ and $^{3}/_{16}$ and convert to like fractions.

$$\frac{1}{4} = \frac{1 \times 16}{4 \times 16} = \frac{16}{64} \quad \text{and} \quad \frac{3}{16} = \frac{3 \times 4}{16 \times 4} = \frac{12}{64}$$

Because a common denominator is any denominator into which the denominators of both fractions will divide evenly, two fractions can have a number of common denominators. Although it is easy to find common denominators by multiplying the denominators by one another, this often leads to numbers that are awkward to work with. For that reason, fractions are usually added after the *lowest* common denominator has been found.

EXAMPLE: Common denominators for the fractions $^{1}/_{4}$ and $^{3}/_{16}$ include 16, 32, 48, 64, 80, and many more.

$^{4}/_{16}$ and $^{3}/_{16}$
$^{8}/_{32}$ and $^{6}/_{32}$
$^{12}/_{48}$ and $^{9}/_{48}$
$^{16}/_{64}$ and $^{12}/_{64}$
$^{20}/_{80}$ and $^{15}/_{80}$

The lowest common denominator is the lowest one into which the others can be divided evenly. To find the lowest common denominator, find any common denominator by the method shown above, and reduce it.

EXAMPLE: Convert the fractions $^{6}/_{15}$ and $^{3}/_{10}$ to like fractions with the lowest common denominator.

$$\frac{6}{15} = \frac{6 \times 10}{15 \times 10} = \frac{60}{150} = \frac{12}{30} \quad \text{and} \quad \frac{3}{10} = \frac{3 \times 15}{10 \times 15} = \frac{45}{150} = \frac{9}{30}$$

ASSIGNMENT SHEET #7

To change a fraction to its equivalent with a higher denominator, multiply the denominator of the given fraction by a number that will give the desired denominator; then multiply the numerator of the fraction by the same multiplier.

EXAMPLE: You want to find out how many eighths there are in $\frac{1}{2}$.

$\frac{1}{2 \times 4} = \frac{?}{8}$ Multiply the denominator by 4 to give you the eighths denominator.

$\frac{1}{2} = \frac{?}{8}$ $\frac{1 \times 4}{2 \times 4} = \frac{4}{8}$ $\frac{1}{2} = \frac{4}{8}$

To change a fraction to its equivalent with a lower denominator, divide both the denominator and the numerator by the same number.

EXAMPLE: You want to find out how many fourths there are in $\frac{12}{16}$.

$\frac{12}{16} = \frac{?}{4}$ $\frac{12 \div 4}{16 \div 4} = \frac{3}{4}$ $\frac{12}{16} = \frac{3}{4}$

PART I

Convert each of the fractions below to equivalent fractions for the denominator given.

A. $\frac{1}{2} = \frac{\_\_}{8}$

B. $\frac{1}{4} = \frac{\_\_}{32}$

C. $\frac{12}{16} = \frac{\_\_}{4}$

D. $\frac{10}{32} = \frac{\_\_}{16}$

E. $\frac{6}{8} = \frac{\_\_}{4}$

F. $\frac{5}{8} = \frac{\_\_}{32}$

G. $\frac{9}{16} = \frac{\_\_}{32}$

H. $\frac{18}{32} = \frac{\_\_}{16}$

I. $\frac{3}{4} = \frac{\_\_}{8}$

J. $\frac{7}{8} = \frac{\_\_}{32}$

K. $\frac{24}{32} = \frac{\_\_}{4}$

L. $\frac{28}{64} = \frac{\_\_}{16}$

PART II

Multiply the denominators in the following sets of fractions to convert them to like fractions.

A. $\frac{3}{8}$ and $\frac{1}{2}$ = __________ and __________

B. $\frac{3}{4}$ and $\frac{9}{32}$ = __________ and __________

ASSIGNMENT SHEET #7

C. $\frac{1}{16}$ and $\frac{5}{8}$ = __________ and __________

D. $\frac{1}{2}$ and $\frac{7}{16}$ = __________ and __________

E. $\frac{3}{4}$ and $\frac{9}{16}$ and $\frac{7}{32}$ = __________ and __________ and __________

PART III

Change the following sets of fractions to like fractions with the *lowest* common denominators.

A. $\frac{3}{10}$ and $\frac{1}{4}$ = __________ and __________

B. $\frac{2}{3}$ and $\frac{3}{16}$ = __________ and __________

C. $\frac{3}{4}$ and $\frac{9}{32}$ = __________ and __________

D. $\frac{1}{2}$ and $\frac{7}{16}$ = __________ and __________

E. $\frac{3}{4}$ and $\frac{5}{8}$ and $\frac{7}{10}$ = __________ and __________ and __________

BASIC MATH
UNIT I

ASSIGNMENT SHEET #8 — CONVERT FRACTIONS AND MIXED NUMBERS

NAME ______________________________ SCORE ____________

A fraction such as $^{3}/_{4}$ is called a *proper fraction* because its numerator (top number) is smaller than its denominator (bottom number). Some examples of proper fractions are $^{2}/_{3}$, $^{1}/_{5}$, and $^{7}/_{8}$.

When the numerator of a fraction is the same, or larger, than the denominator, the fraction is called an *improper fraction*. Some examples of improper fractions are $^{4}/_{4}$, $^{5}/_{3}$, $^{9}/_{4}$, and $^{10}/_{8}$.

Numbers such as $2^{1}/_{2}$, $5^{3}/_{4}$, and $6^{2}/_{5}$ are called *mixed numbers*. They are made up of a whole number and a proper fraction.

Complete the following exercises. Refer to Information Sheet, Sections VIII, X, and XI if necessary.

PART I

A. Distinguish among the following fractions by writing a "P" in the blanks before a proper fraction, an "I" before an improper fraction, and an "M" in the blanks before a mixed number.

_____ 1. $^{1}/_{2}$

_____ 2. $3^{7}/_{8}$

_____ 3. $^{16}/_{2}$

_____ 4. $3^{1}/_{8}$

_____ 5. $^{1}/_{4}$

_____ 6. $^{1}/_{1}$

_____ 7. $^{7}/_{2}$

_____ 8. $8^{1}/_{2}$

_____ 9. $^{4}/_{4}$

_____ 10. $9^{3}/_{16}$

_____ 11. $5^{1}/_{2}$

_____ 12. $^{9}/_{8}$

_____ 13. $^{9}/_{4}$

_____ 14. $^{1}/_{8}$

_____ 15. $16^{3}/_{4}$

B. Write a numerator over each of the following denominators to make proper fractions.

1. $\frac{\quad}{8}$

2. $\frac{\quad}{4}$

3. $\frac{\quad}{32}$

4. $\frac{\quad}{2}$

5. $\frac{\quad}{16}$

ASSIGNMENT SHEET #8

C. Write a numerator over each of the following denominators to make improper fractions.

1. $\frac{}{2}$

2. $\frac{}{4}$

3. $\frac{}{16}$

4. $\frac{}{8}$

5. $\frac{}{4}$

PART II

A. Convert each of the following mixed numbers to improper fractions. Reduce to lowest terms when possible.

1. $3\,{}^{1}/_{4}$ = ______
2. $4\,{}^{1}/_{2}$ = ______
3. $7\,{}^{3}/_{4}$ = ______
4. $8\,{}^{1}/_{2}$ = ______
5. $6\,{}^{1}/_{8}$ = ______
6. $5\,{}^{2}/_{4}$ = ______
7. $4\,{}^{1}/_{4}$ = ______
8. $8\,{}^{1}/_{2}$ = ______
9. $9\,{}^{1}/_{4}$ = ______
10. $16\,{}^{1}/_{2}$ = ______

B. Convert each of the following improper fractions to mixed numbers. Reduce to lowest terms when possible.

1. ${}^{7}/_{4}$ = ______
2. ${}^{9}/_{2}$ = ______
3. ${}^{6}/_{4}$ = ______
4. ${}^{15}/_{8}$ = ______
5. ${}^{19}/_{16}$ = ______
6. ${}^{11}/_{8}$ = ______
7. ${}^{75}/_{32}$ = ______
8. ${}^{5}/_{2}$ = ______
9. ${}^{15}/_{4}$ = ______
10. ${}^{33}/_{16}$ = ______

BASIC MATH
UNIT I

ASSIGNMENT SHEET #9 — ADD FRACTIONS

NAME ______________________________ SCORE ______________

One of the most common calculations done by a carpenter is the addition of fractions. For example, boards are seldom cut to lengths of even feet or inches. Often the length of a cut can only be determined by adding several dimensions, any of which may include a fraction. For accurate construction, the lengths must be figured correctly.

To add common fractions, change to equivalent fractions with lowest common denominators. Add the new numerators and place this sum over the lowest common denominator. If the result is an improper fraction, change it to a mixed number and reduce to lowest terms.

EXAMPLE: $\frac{2}{3} + \frac{3}{4} = \frac{8}{12} + \frac{9}{12} = \frac{17}{12} = 1\frac{5}{12}$

Find common denominators and add the following fractions. Reduce to lowest terms. Refer to Information Sheet, Section XII if necessary.

A. $\frac{1}{4} + \frac{2}{8} =$ __________

E. $\frac{3}{4} + \frac{5}{32} =$ __________

B. $\frac{4}{16} + \frac{3}{4} =$ __________

F. $\frac{7}{8} + \frac{5}{16} =$ __________

C. $\frac{5}{8} + \frac{3}{32} =$ __________

G. $\frac{9}{16} + \frac{3}{4} =$ __________

D. $\frac{9}{16} + \frac{5}{8} =$ __________

H. $\frac{4}{4} + \frac{25}{32} =$ __________

ASSIGNMENT SHEET #9

I. An adhesive for installing plastic laminate on cabinet tops requires mixing a base liquid and a hardener. How many gallons of adhesive will be produced if you must mix 1 pint of hardener with 2 quarts of base?

(NOTE: There are 8 pints in a gallon. There are 4 quarts in a gallon.)

Gallons of adhesive = ____________________

J. A contractor puts both fiberboard and foil-backed styrofoam insulation on the exterior walls of houses. How much does this increase the thickness of a wall if the actual thickness of the fiberboard is $^{7}/_{16}$ inch and the actual thickness of the insulation is $^{21}/_{32}$ inch?

Increase in thickness = ____________________

K. Composition shingles are sold by the "square" — that is, the shingles required to cover 100 square feet of roof. There are three bundles of shingles per square. How many squares of shingles are left if a contractor has five bundles of shingles left from one job and two bundles left from another?

Number of squares = ____________________

L. How high above the subflooring must a carpenter hang a door if the door must clear the carpeting by $^{1}/_{8}$ inch, the carpet pad is $^{1}/_{2}$-inch thick, and the carpet is $^{9}/_{16}$-inch thick?

Height above subflooring = ____________________

M. A carpenter needs a door jamb that will cover the end of a wall that has $^{3}/_{8}$ inch of paneling and $^{1}/_{2}$ inch of plasterboard on each side of a $3^{1}/_{2}$-inch wall stud. How wide must the jamb be?

Width of jamb = ____________________

BASIC MATH
UNIT I

ASSIGNMENT SHEET #10 -- SUBTRACT FRACTIONS

NAME ______________________________ SCORE ______________

Just as carpenters must frequently add fractions, they must also subtract fractions. Although the dimensions on a blueprint may look nice and even, the actual construction leads to many fractional measurements. For example, a blueprint may show that a door is 2′ – 4″ wide. However, the carpenter will leave a rough opening of approximately 2′ – 7½″ because the door frame will reduce the opening. Subtraction of fractions is helpful in figuring such reductions.

To subtract common fractions, change to equivalent fractions with common denominators. Find the difference between the numerators of the equivalent fractions. Place the difference over the common denominator and, if necessary, reduce the answer to lowest terms.

EXAMPLE: $\frac{2}{3} - \frac{1}{4}$ becomes $\frac{8}{12} - \frac{3}{12} = \frac{5}{12}$

Subtract each of the common fractions given below. Reduce to lowest terms. Refer to Information Sheet, Section XIII if necessary.

A. $\frac{3}{4} - \frac{3}{16} =$ __________

B. $\frac{7}{8} - \frac{1}{4} =$ __________

C. $\frac{30}{32} - \frac{3}{4} =$ __________

D. $\frac{25}{32} - \frac{5}{8} =$ __________

E. $\frac{7}{8} - \frac{2}{16} =$ __________

F. $\frac{15}{16} - \frac{3}{8} =$ __________

G. $\frac{1}{2} - \frac{7}{16} =$ __________

H. $\frac{3}{4} - \frac{3}{8} =$ __________

I. $\frac{13}{16} - \frac{9}{32} =$ __________

J. $\frac{7}{8} - \frac{6}{16} =$ __________

ASSIGNMENT SHEET #10

K. The actual dimensions of a two-by-four board are 1 1/2" × 3 1/2". How much difference is there between the stated width and actual width of a two-by-four board?

Difference in width = ____________________

L. The directions for installing lag bolts state that the carpenter must first drill a hole 1/32 inch smaller than the diameter of the lag bolt. What diameter hole must be drilled if a carpenter uses lag bolts with a 9/16-inch diameter to install beams?

Hole diameter = ____________________

M. What is the difference in thickness between 1/2-inch plywood and 5/8-inch plywood?

Difference in thickness = ____________________

N. A saw blade removes 1/64 inch of wood for each cut. A board 47 5/8 inches long is cut in two. If one piece is 24 1/2 inches long, how long is the other piece?

Length = ____________________

O. A 12-penny nail is 3 1/4 inches long, not counting the head. If a two-by-four board is actually 1 1/2-inch thick, how much of the nail will extend beyond the board if you drive a 12-penny nail through a two-by-four board?

Length of extended part of nail = ____________________

BASIC MATH
UNIT I

ASSIGNMENT SHEET #11 — MULTIPLY FRACTIONS

NAME ______________________________ SCORE ______________

Multiplying with fractions is often a shortcut for adding fractions; and because carpenters often add similar fractions, they can multiply to save time. For example, to figure a window opening in which five windows $23\frac{3}{4}$ inches wide are to be installed, it is much easier to multiply the width by the number of windows rather than to add $23\frac{3}{4}$ inches five times. A good carpenter quickly learns to appreciate the convenience of being able to multiply fractions when possible.

To multiply fractions, multiply the numerators and denominators separately. Write the product of the numerator over the product of the denominator and reduce to lowest terms.

EXAMPLE: $\frac{2}{3} \times \frac{3}{4}$ becomes $\frac{2 \times 3}{3 \times 4} = \frac{6}{12} = \frac{1}{2}$

Multiply the following fractions. Convert mixed fractions where needed and reduce answers to lowest terms. Refer to Information Sheet, Section XIV if necessary.

A. $\frac{1}{2} \times \frac{3}{4} =$ ______

B. $\frac{3}{8} \times \frac{5}{16} =$ ______

C. $1\frac{1}{2} \times 2\frac{1}{4} =$ ______

D. $\frac{1}{2} \times 6\frac{1}{2} =$ ______

E. $\frac{7}{8} \times \frac{2}{3} =$ ______

F. $1\frac{1}{3} \times 2\frac{1}{4} \times \frac{1}{2} =$ ______

G. $\frac{1}{4} \times \frac{1}{3} \times \frac{1}{2} =$ ______

H. $2\frac{3}{4} \times 6\frac{1}{8} =$ ______

ASSIGNMENT SHEET #11

I. A porch roof slopes in such a way that the roof is 1/4 foot higher for each horizontal foot along the base of the roof. What is the total rise in feet if the porch roof rises for a distance of 8 1/2 feet?

Total rise = ____________________

J. A certain adhesive requires mixing 3/4 gallon base and 1/4 gallon hardener to make a gallon of adhesive. How much base should a worker use if she needs to mix only 1/3 gallon of adhesive?

Amount of base = ____________________

K. There are 296 four-penny nails per pound. How many nails are there in 1/4 pound?

Number of nails = ____________________

L. After completing an addition of houses, a contractor has 8 2/3 squares of shingles left in three different colors. If one-half of the shingles are brown-blend, how many squares of brown-blend shingles are there?

Number of squares of brown-blend shingles = ____________________

M. A carpenter is installing a lockset in a 1 3/4-inch-thick door. He wants to drill a hole in the edge of the door for the strike, and he wants the strike centered on the edge. Where must the hole be drilled if the strike is centered half way across the 1 3/4-inch edge?

Hole location = ____________________ from each side of edge

BASIC MATH
UNIT I

ASSIGNMENT SHEET #12 — ADD DECIMAL NUMBERS

NAME ______________________________ SCORE ______________

As a consumer of raw materials, a carpenter often needs to calculate the costs of building a structure. Such costs are figured in dollars and cents. But cents are only decimal parts of a dollar, and every time carpenters or anyone else totals the cost of a purchase, they are adding decimals.

You can add decimals just as you add whole numbers. You must be careful, though, to keep all decimal points aligned.

Add each column of numbers, carrying when necessary. Place a decimal point in the answer directly under the decimal points above. Refer to Information Sheet, Section XVI if necessary.

EXAMPLES:

$$\begin{array}{r} 0.26 \\ +\ 0.168 \\ \hline 0.428 \end{array} \qquad \begin{array}{r} \$4.60 \\ +\ \ \ .40 \\ \hline \$5.00 \end{array}$$

A. $\begin{array}{r} 0.024 \\ +\ 0.165 \\ \hline \end{array}$

B. $\begin{array}{r} 0.873 \\ +\ 0.199 \\ \hline \end{array}$

C. $\begin{array}{r} \$4.60 \\ +\ \ 4.62 \\ \hline \end{array}$

D. $\begin{array}{r} 0.0003 \\ +\ 0.0099 \\ \hline \end{array}$

E. $\begin{array}{r} \$62.14 \\ +\ \ \ 8.87 \\ \hline \end{array}$

F. $\begin{array}{r} \$34.87 \\ +\ \ 96.45 \\ \hline \end{array}$

G. $\begin{array}{r} 195.7 \\ 83. \\ +\ \ \ 9.006 \\ \hline \end{array}$

H. $\begin{array}{r} 0.0131 \\ 0.1640 \\ +\ 0.2229 \\ \hline \end{array}$

I. $\begin{array}{r} 4.612 \\ 0.958 \\ +\ 0.885 \\ \hline \end{array}$

J. $\begin{array}{r} 4937.23 \\ 4980.47 \\ 10234.97 \\ +\ \ 9872.21 \\ \hline \end{array}$

K. $\begin{array}{r} 15.125 \\ 4.625 \\ 20.125 \\ +\ 16.125 \\ \hline \end{array}$

L. $\begin{array}{r} 0.52802 \\ 0.34007 \\ 0.00321 \\ +\ 0.00009 \\ \hline \end{array}$

ASSIGNMENT SHEET #12

M. A contractor bought some roofing materials and spent $141.72 for shingles, $16.81 for felt paper, and $6.27 for flashing. What was the total cost of the roofing materials?

Total cost = ____________________

N. A trim carpenter worked four days for a certain contractor. She worked 6.8 hours Monday, 7.4 hours Tuesday, 9.3 hours Wednesday, and 4.4 hours Thursday. How many total hours did she work for the contractor?

Total hours worked = ____________________

O. How much was spent on tools if a carpenter bought the tools below at the prices listed?

Circular saw	$95.88
Hand saw	$9.95
Drill bit	39¢
Hammer	$6.49
Hammer	$10

Total cost = ____________________

P. For tax purposes, a carpenter must keep track of mileage driven in the line of work. During the past quarter, he drove 386.4 miles the first month, 519 miles the second month, and 461.2 miles the third month. What was his total mileage for the quarter?

Total mileage = ____________________

ASSIGNMENT SHEET #12

Q. A contractor is interested in building energy-efficient houses and would like to advertise the insulation values of his houses. To do this, he must figure the thermal resistance (R) value for the structure. For the exterior walls he uses the materials given below with the R values stated. What is the total R value of these materials?

Material	**R-Value**
Brick, 3"	0.60
Vapor barrier	0.84
Foil-wrapped polystyrene siding	6.25
Blown fiberglass	18.41
Drywall, ½"	0.45

Total R value = ____________________

BASIC MATH
UNIT I

ASSIGNMENT SHEET #13 — SUBTRACT DECIMAL NUMBERS

NAME ______________________________ SCORE ______________

Decimals are a part of our daily lives, not only in figuring money but also in calculating time, distance, area, and many other quantities. In the carpentry trade, decimals are becoming more common, especially with the increased use of metric measurements. Subtraction is one of the basic mathematical operations done with decimals in the trade.

Set up each of the following problems in column form. Subtract and check your work. Remember, when you subtract decimals, the decimal points must be aligned. Refer to Information Sheet, Section XVII [illegible] necessary.

A. 868.87 – 516.89 = ____________________

B. 567 – 19.856 = ____________________

C. 198 – 56.987 = ____________________

D. 567.94 – 59.78 = ____________________

E. $815.23 – $65.98 = ____________________

ASSIGNMENT SHEET #13

F. $20.03 - $15.88 = ____________________

G. 694.7 - 24.3 = ____________________

H. 5,000 - 892.66 = ____________________

I. $15 - $12.53 = ____________________

J. $219.30 - $21.85 = ____________________

K. A carpenter keeps track of mileage driven on the job. At the beginning of the month, the vehicle odometer reads 29,268.4. At the end of the month, the odometer reads 29,872.1. How many miles were driven during the month?

Miles driven for month = ____________________

L. A carpenter completed a remodeling project and computed his profit. He was paid $6,500.00 for the project. How much profit did he make if his expenses were $4,718.96?

Profit = ____________________

ASSIGNMENT SHEET #13

M. A carpenter has been using 12-gauge and 14-gauge flashing. In order to determine what screws to use to install skylights, she must know the difference in thickness of the two gauges. What is the difference if 12-gauge is 0.0808-inch thick and 14-gauge is 0.0641-inch thick?

Difference in thickness = ______________________

N. A carpenter bought plywood on sale. He had estimated the cost to be $1,238.62 based on the regular price. How much did he save if the cost on sale was $1,061.19?

Savings = ______________________

O. A floor plan has 1,781 square feet of living space. A change is made to the plan, reducing the living space by 264.5 square feet. What is the area of the modified plan?

Area of modified plan = ______________________

BASIC MATH
UNIT I

ASSIGNMENT SHEET #14 — MULTIPLY DECIMAL NUMBERS

NAME ____ SCORE ________________

Carpenters work with many geometric shapes and are often required to calculate the area of such shapes. The formulas used in computing the areas of shapes often require multiplying by decimals, such as in using 3.14 to figure the area of a circle. Additionally, costs and earnings may be calculated by multiplying with decimals—an essential skill for any good carpenter.

Multiplication with decimals is similar to multiplication with whole numbers. However, with decimals you must take care in placing the decimal point correctly. The number of decimal places in an answer must equal the total number of decimal places in the numbers that you multiplied.

EXAMPLE:

```
  16.11  2 Decimal Places
 x  2.2  1 Decimal Place
 ------
   3222
  3222
 ------
 35.442  3 Decimal Places in Answer
```

Set up each of the following problems in column form and multiply. Locate the decimal point in the answer. Refer to Information Sheet, Section XVIII if necessary.

A. 2.64 × 3.1 = ____________________

B. 120 × 0.33 = ____________________

ASSIGNMENT SHEET #14

C. 2.25 × 0.51 = ____________________

D. 35 × 8.5 = ____________________

E. 26.4 × 3.8 = ____________________

F. 7.02 × 0.92 = ____________________

G. 0.83 × 0.55 = ____________________

ASSIGNMENT SHEET #14

H. 28.2 × 0.9 = ____________________

I. 0.069 × 0.01 = ____________________

J. 7.52 × 3.01 = ____________________

K. A radial arm saw is placed on sale for 25 percent off. How much is the price reduced if the regular price is $1349.80?

(NOTE: Twenty-five percent is the same as the decimal 0.25.)

Price reduction = ____________________

ASSIGNMENT SHEET #14

L. The average cost per square foot of houses in a certain area is $41.25. What would be the approximate cost of a 1500-square-foot house?

Approximate cost = ____________________

M. A building code specifies a maximum grade for lawns of 33.3 percent, which means that the maximum slope for a lawn 100 feet in length would be 33.3 feet. How much slope would be allowed for a lot 75 feet deep?

Slope = ____________________

N. A carpenter buys 38 hinge sets at a cost of $3.49 each. What is the total cost?

Total cost = ____________________

O. If the average weight of composition shingles is 2.5 pounds per square foot, what is the total weight of the composition roofing on a 831.75 square foot area?

Total weight = ____________________

BASIC MATH
UNIT I

ASSIGNMENT SHEET #15 — DIVIDE DECIMAL NUMBERS

NAME ______________________________ SCORE ______________

A carpenter will usually have to shop around to find the best buys in tools and materials. Price comparisons often become difficult because not all suppliers base their prices on the same unit. For example, one supplier may price plywood by the sheet while another quotes costs as so much a square foot. Being able to divide decimal numbers will help a carpenter determine the best buys. Division with decimal numbers is also useful in figuring quantities of materials, weighing job opportunities, and in many other aspects of the trade.

Division with decimals is like division with whole numbers. However, before you begin to divide, you must decide where the decimal point should be placed in the number.

First study the divisor. If it has a decimal, move the decimal point to the right so that you change the decimal to a whole number. Then move the decimal point the same number of places to the right in the original number (number into which you are dividing).

EXAMPLE 1: Decimal point moved one place in both numbers.

$$\underset{\curvearrowright}{.2}\,\overline{)\underset{\curvearrowright}{.4}} \qquad\qquad \begin{array}{r} 2. \\ 2.\,\overline{)4.} \\ \underline{4} \\ 0 \end{array}$$

EXAMPLE 2: Decimal point moved two places in both numbers.

$$\underset{\curvearrowright}{.14}\,\overline{)\underset{\curvearrowright}{.14}028} \qquad\qquad \begin{array}{r} 1.002 \\ 14.\,\overline{)14.028} \\ \underline{14} \\ 0\,028 \\ \underline{28} \\ 0 \end{array}$$

EXAMPLE 3: Decimal point moved one place in both numbers; note that a zero had to be added.

$$1\underset{\curvearrowright}{.3}\,\overline{)26\underset{\curvearrowright}{.0}} \qquad\qquad \begin{array}{r} 20. \\ 13.\,\overline{)260.} \\ \underline{26} \\ 00 \end{array}$$

EXAMPLE 4: No decimal point was moved to the right because 3 is already a whole number.

$$3\,\overline{).6} \qquad\qquad \begin{array}{r} .2 \\ 3\,\overline{).6} \\ \underline{6} \\ 0 \end{array}$$

ASSIGNMENT SHEET #15

Divide numbers in the following problems. Show your work. Refer to Information Sheet, Section XIX if necessary, and check your answers.

A. 4.5 ÷ 0.5 = ____________________

B. 4.96 ÷ 0.4 = ____________________

C. 19.8 ÷ 0.6 = ____________________

D. 10.71 ÷ 0.07 = ____________________

E. 0.225 ÷ 0.15 = ____________________

F. 1.7608 ÷ 0.0062 = ____________________

G. 0.48 ÷ 0.6 = ____________________

ASSIGNMENT SHEET #15

H. 0.125 ÷ 0.25 = ____________________

I. 0.9 ÷ 0.003 = ____________________

J. 1.16 ÷ 2.9 = ____________________

K. 75 ÷ 0.03 = ____________________

L. 108 ÷ 0.09 = ____________________

M. 84 ÷ 0.007 = ____________________

N. 459 ÷ 2.7 = ____________________

ASSIGNMENT SHEET #15

O. 406 ÷ 0.029 = ____________________

P. What is the approximate cost per sheet of plywood if the cost of twelve sheets is $103.68?

Approximate cost = ____________________

Q. How many hours did a carpenter work if she was paid a total of $681.75 at the rate of $22.50 per hour?

Total hours = ____________________

R. How many lots can be platted on a 21.12-acre addition if the average lot is 0.66 acres?

Number of lots = ____________________

S. A carpenter spent $172.80 for doors. What was the cost per door if he bought eight doors?

Cost per door = ____________________

T. If it takes a roofer 12.6 hours to lay a 1680 square-foot roof, how long does it take to lay one square of shingles?

Length of time = ____________________

BASIC MATH
UNIT I

ASSIGNMENT SHEET #16 — CONVERT FRACTIONS AND PERCENTAGES

NAME ______________________________ SCORE ______________

In carpentry, percentage is often useful. Percent means per hundredths. Five percent means five one-hundredths and may be written three ways: 5/100, 0.05, and 5%. All have the *same* mathematical value.

Complete the following exercises. Refer to Information Sheet, Sections XX through XXII if necessary.

PART I

A. Express each of the following fractions as a decimal.

1. 1/8 = __________
2. 1/4 = __________
3. 1/2 = __________
4. 3/4 = __________
5. 5/8 = __________
6. 1/16 = __________
7. 3/32 = __________
8. 7/8 = __________
9. 9/16 = __________
10. 15/16 = __________

B. Express each of the following fractions as a percentage.

1. 1/4 = __________
2. 1/2 = __________
3. 7/10 = __________
4. 3/4 = __________
5. 2/2 = __________

ASSIGNMENT SHEET #16

6. $^{1}/_{10}$ = ____________

7. $^{7}/_{8}$ = ____________

8. $^{5}/_{10}$ = ____________

9. $^{1}/_{3}$ = ____________

10. $^{5}/_{8}$ = ____________

PART II

Fractions having denominators of ten, or one of the powers of ten (place values), are easily written as decimal numbers. Simply allow as many places to the right of the decimal point as there are zeros in the denominator.

EXAMPLES:	$1^{5}/_{10} = 1.5$	tenths
	$1^{25}/_{100} = 1.25$	hundredths
	$1^{125}/_{1000} = 1.125$	thousandths

A. Match the decimal numbers on the right to their correct equivalent fractions. Write the correct letters in the blanks.

_____	1. $5^{6}/_{10}$	a. 7.083
_____	2. $1^{2}/_{100}$	b. 5.006
_____	3. $^{87}/_{1000}$	c. 78.3
_____	4. $7^{83}/_{1000}$	d. 0.087
_____	5. $5^{6}/_{100}$	e. 0.783
_____	6. $5^{6}/_{1000}$	f. 87.7
_____	7. $78^{3}/_{10}$	g. 5.6
_____	8. $87^{7}/_{10}$	h. 102.0
_____	9. 102	i. 5.06
_____	10. $^{783}/_{1000}$	j. 1.02

ASSIGNMENT SHEET #16

B. Write decimal equivalents for each of the following fractions.

1. $63\frac{9}{10}$ = ______
2. $5\frac{93}{100}$ = ______
3. $5\frac{93}{1000}$ = ______
4. $5\frac{93}{10000}$ = ______
5. $3\frac{825}{1000}$ = ______
6. $38\frac{95}{100}$ = ______
7. $38\frac{95}{1000}$ = ______
8. $42\frac{3}{10}$ = ______
9. $402\frac{3}{10}$ = ______
10. $897\frac{97}{100000}$ = ______

PART III

A. Express each of the following percentages as a fraction. Reduce the lowest terms.

1. 50% = ______
2. 25% = ______
3. $33\frac{1}{3}$% = ______
4. 36% = ______
5. 28% = ______
6. $14\frac{2}{7}$% = ______
7. 21% = ______
8. 75% = ______
9. $66\frac{2}{3}$% = ______
10. 70% = ______

B. Express each of the following percentages as a decimal.

1. 47% = ______
2. 15% = ______
3. 33.3% = ______
4. 62% = ______
5. 75% = ______
6. 3% = ______
7. 16.8% = ______
8. 9% = ______
9. 10% = ______
10. 50% = ______

BASIC MATH
UNIT I

ASSIGNMENT SHEET #17 — SOLVE PERCENTAGE PROBLEMS

NAME ______________________________ SCORE ______________

In the carpentry field, you will frequently come across percentages. Interest rates, pricing discounts, waste allowances, the rise or decline of housing starts, and many other factors that affect the industry are stated as percentages. To make the most of your career in this field, you must understand what percentages mean and how they are used.

Solve the following percentage problems. Refer to Information Sheet, Section XXIII if necessary.

PART I

A. What does it mean to say 100 percent of the work is completed? ______________

____

B. There are usually 100 tools in the tool shed. Fourteen of them are missing. What percent of the tools are missing? ______________________________

C. If 14 of the tools are missing in the above problem, how many are present? ________

What percent are present? ______________________________

D. There are 100 studs in a stack. Twenty-five studs are what percent of the studs in the stack? ______________________________

Five studs are what percent of the studs in the stack? ______________

ASSIGNMENT SHEET #17

E. There are 100 jobs on the agenda. Ninety-four have been completed. What percent of the jobs have been completed? ______________________

F. If 94 of the jobs in the above problem have been completed, how many have not been?

____

What percent have not been completed? ______________________

G. If 11 percent of the students in a school are absent, what percent are present? ______

H. If 6 percent of the hand saws that a store had in stock were not sold, what percent were sold?______________________

I. If 60 percent of the carpenters in town had cards, what percent did not have cards?

____

J. Bill has a set of carpentry tools. Ten percent of his tools are a year old, and 40 percent are over a year old. What percent are less than a year old? ______________________

ASSIGNMENT SHEET #17

K. Susan has three types of screwdrivers—flat, Philips, and square. Eighty percent of her screwdrivers are flat, and 15 percent are square. What percent are Philips? __________

L. The Smiths spent 22 percent of their income for their business: 17 percent for tools, 15 percent for work clothes, and 8 percent for entertainment. What percent was left for other things? __________

M. Chester has finished 75 percent of the job he is doing. What percent does he still have to do? __________

N. Betty has completed 40 percent of her training. What percent does she still have to do? __________

O. If you were told to complete 93 percent of the work, what percent would be left? __________

ASSIGNMENT SHEET #17

PART II

Solve each of the following percentage problems.

A. 3% of 72 is what number? ___________

B. 5% of 18 is what number? ___________

C. What number is 33⅓% of 96? ___________

D. 40% of 125 is what number? ___________

E. 68% of 63.5 is what number? ___________

F. What number is 12½% of 140.8? ___________

G. What number is 1% of 103? ___________

H. What number is 37½% of 152? ___________

I. 50% of 32.8 is what number? ___________

J. 7% of 163 is what number? ___________

ASSIGNMENT SHEET #17

PART III

Solve the following percentage word problems. Show your work.

A. There are 20 students in a class. Sixty percent of the students are boys.

How many are boys? ___________

B. One day 5 percent of the 20 carpenters in Mr. Moore's group made perfect time completing a job. How many carpenters made perfect time? ___________

C. Contractor McGill bought a new miter saw—regularly selling for $120—at a sale and saved 20 percent. How much money did he save? ___________

D. The number of carpenters at the meeting this week was 75 percent of what it was last week. Last week there were 800 carpenters at the meeting. How many carpenters were at the meeting this week? ___________

BASIC MATH
UNIT I

ASSIGNMENT SHEET #18 — CALCULATE AREA

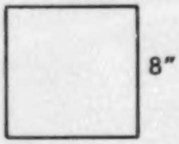
NAME ______________________________ SCORE ______________

One of the most common mathematical operations in estimating materials is the calculation of area. You must figure area on roofs for shingles, on walls and ceilings for drywall and other coverings, in attics and walls for insulation, on floors for flooring and floor coverings, on exterior walls for finishing materials, and in many other areas of construction. In fact, the basic pricing unit in the industry is figured on the area of a structure. Therefore, to understand the costs of materials and construction, you must learn to calculate area.

Calculate area for the following problems. Refer to Information Sheet, Section XXVII if necessary.

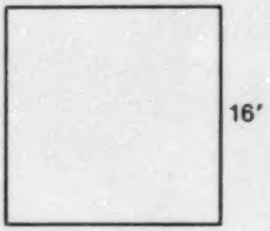
A. Calculate the area for each of the following squares.

1.



A = ______________________________

2.



A = ______________________________

3. Square = 15 feet

A = ______________________________

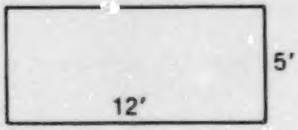
4. Square = 36 yards

A = ______________________________

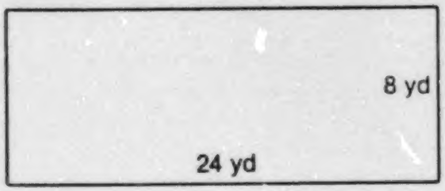
ASSIGNMENT SHEET #18

B. Calculate area for each of the following rectangles.

1.



2.



A = ____________________

A = ____________________

3. L = 17″; W = 31″

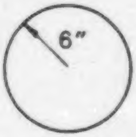
4. L = 16′; W = 62′

A = ____________________

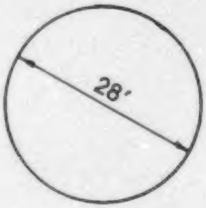
A = ____________________

C. Calculate area for each of the following circles. (Use $\pi = 3.14$.)

1.



2.



A = ____________________

A = ____________________

3. Radius = 16′

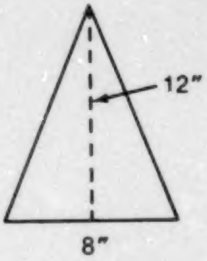
4. Diameter = 25 yards

A = ____________________

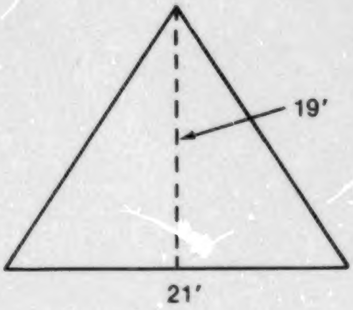
A = ____________________

D. Calculate area for each of the following triangles.

1.



2.



A = ____________________

A = ____________________

3. b = 13″; h = 3″

4. b = 24 yards; h = 15 yards

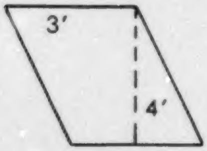
A = ____________________

A = ____________________

ASSIGNMENT SHEET #18

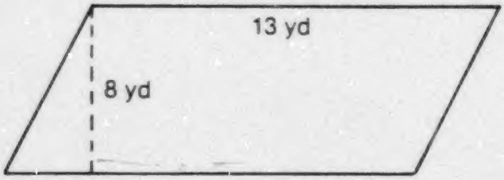
E. Calculate area for each of the following parallelograms.

1.



A = ______________________________

2.



A = ______________________________

3. b = 16"; h = 16"

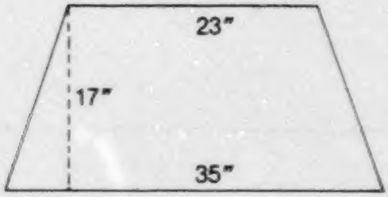
A = ______________________________

4. b = 27 yards; h = 9 yards

A = ______________________________

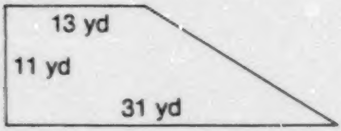
F. Calculate area for each of the following trapezoids.

1.



A = ______________________________

2.


13 yd
11 yd
31 yd

A = ______________________________

ASSIGNMENT SHEET #18

3. $h = 12'$; $b_1 = 9'$; $b_2 = 19'$

4. $h = 17$ yards; $b_1 = 39$ yards; $b_2 = 51$ yards

A = ____________________

A = ____________________

BASIC MATH
UNIT I

ASSIGNMENT SHEET #19 — CALCULATE VOLUME

NAME ____________________ SCORE ____________

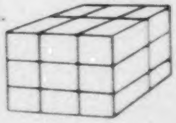
Carpenters should be familiar with volumetric measurements in order to make estimates and to use materials wisely. One of the most common uses of cubic volume measurements is in estimating concrete. But volumetric measurements are also used for heating and air-conditioning systems, ventilation systems, some types of insulation, water and sewage systems, and other construction-related systems. A good carpenter must be familiar with how volume is determined.

PART I

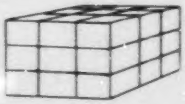
Record the dimensions and volume for the figures below this chart. Remember that volume is the number of cubic units. Refer to Information Sheet, Section XXVIII if necessary.

	Height = H	Width = W	Length = L	Volume = V
A.				
B.				
C.				
D.				
E.				
F.				
G.				
H.				
I.				
J.				

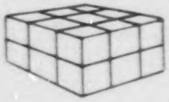
A.



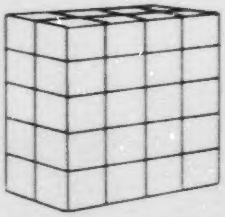
B.



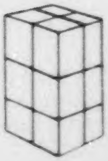
C.



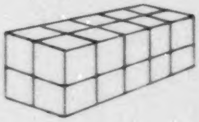
D.



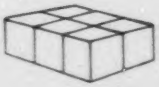
E.



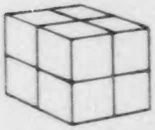
F.



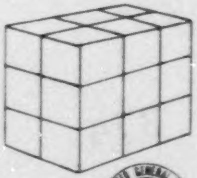
G.



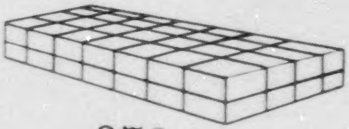
H.



I.



J.



ASSIGNMENT SHEET #19

PART II

Answer the following questions about the boxes illustrated.

____________________ A. How many cubes are there in box #1?

____________________ B. How many cubes are still needed to fill the bottom layer of box #1?

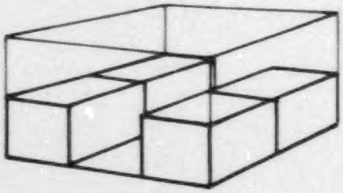
____________________ C. How many layers can box #1 hold inside?

____________________ D. How many cubes are needed for the top layer in box #1?

____________________ E. How many total cubes would there be if box #1 were full?

____________________ F. What is the volume of box #1?

Box #1

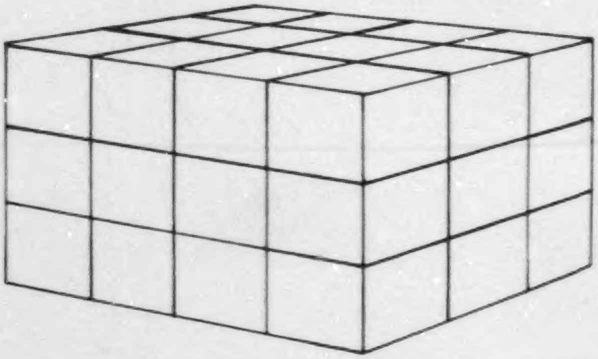


____________________ G. How many cubes are there in the bottom layer of box #2?

____________________ H. How many layers are there in box #2?

____________________ I. What way can volume be figured for box #2 *without counting* each of the cubes?

Box #2



ASSIGNMENT SHEET #19

________________ J. How many cubic inches in 1 cubic foot? (Think of stacking cubic inches in box #3.)

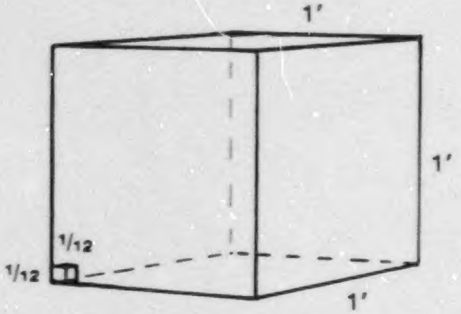
________________ K. How many cubic inches would it take to fill one layer in box #3?

________________ L. How many cubic inches would it take to fill two layers in box #3?

________________ M. How many cubic inches would it take to fill three layers in box #3?

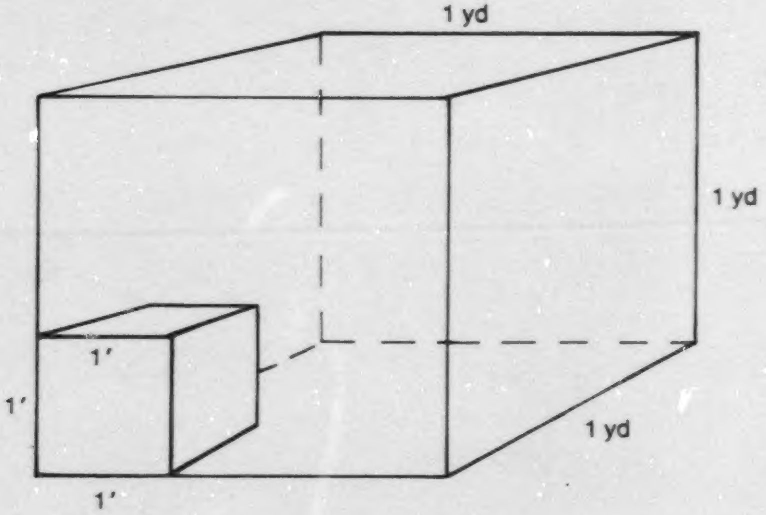
________________ N. How many layers would it take to fill box #3?

Box #3



________________ O. How many cubic feet in 1 cubic yard? (Think of stacking cubic feet in box #4.)

Box #4

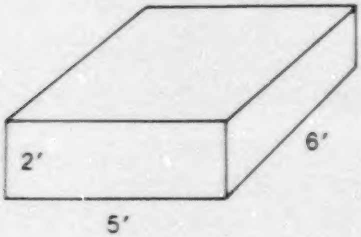


ASSIGNMENT SHEET #19

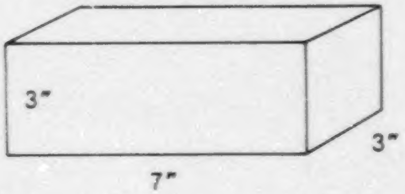
PART III

Use the formula V = LWH to calculate volume for the following figures.

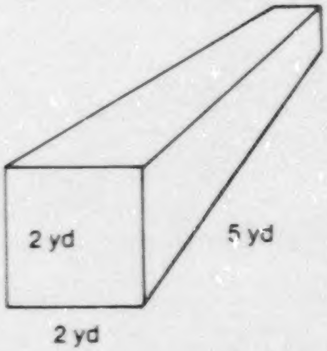
A. V = ______________________________



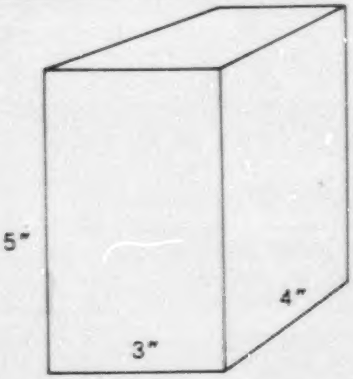
B. V = ______________________________



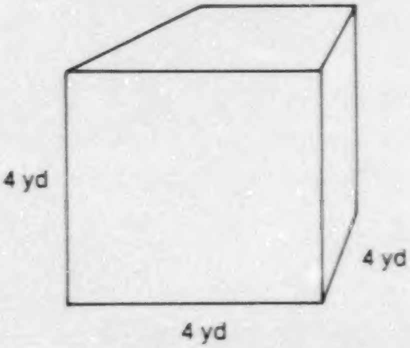
C. V = ______________________________



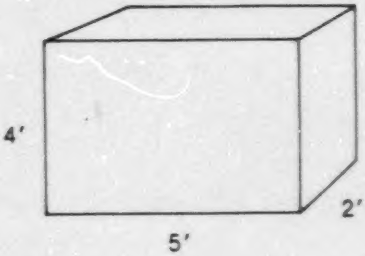
D. V = ______________________________



E. V = ______________________________



F. V = ______________________________



BASIC MATH
UNIT I

ASSIGNMENT SHEET #20 — ESTIMATE CUBIC YARDS

NAME ______________________________ SCORE ______________

Carpenters often have to compute cubic yard measurements to estimate materials and labor. Cubic yards is the basic unit of measurement for excavation and fill dirt, for concrete, for mortars and grouts, and for other materials. Therefore, a carpenter must be able to calculate cubic yard measurements accurately.

Solve the following problems involving cubic yards. Refer to Information Sheet, Section XXVIII if necessary.

A. How many cubic yards of concrete will it take for a driveway 20 feet wide by 72 feet long by 4 inches thick?

Total cubic yards = ______________

B. Find the total cubic yards of insulation it will take to fill a cavity wall if the cavity is 8 feet high, 22 feet long, and 6 inches thick?

Total cubic yards = ______________

C. How many cubic yards of grout will it take to fill a cavity 12 feet high, 37 feet long, and 3 inches thick?

Total cubic yards = ______________

D. Find the total cubic yards of sand it will take to fill a swimming pool 34 feet wide, 45 feet long, and 4 inches thick?

Total cubic yards = ______________

E. How many cubic yards of concrete will it take to pour a sidewalk 6 feet wide, 118 feet long, and 4 inches thick?

Total cubic yards = ______________

BASIC MATH
UNIT I

ASSIGNMENT SHEET #2 — SOLVE BASIC RATIO AND PROPORTION PROBLEMS

NAME ______________________________ SCORE ______________

The carpentry trade uses more ratios and proportions today than ever before. New plastics and adhesives often require mixing. Additionally, mortars and other materials require mixing. Ratios are used to designate grade slopes and relationships such as heat loss and load-bearing capacities. The carpenter will be required to calculate some ratios and proportions, and will be required to apply many others.

Solve the following ratio and proportion problems. Refer to Information Sheet, Section XXIX if necessary. Show your work.

A. Convert the ratio 0.25:0.25:1 to the smallest proportion possible containing whole numbers.

Proportion = ____________________

B. What would be the proportion if a 1:2:12 mix were cut in half?

Proportion = ____________________

C. What would be the proportion if the ratio 1:1:3 were tripled?

Proportion = ____________________

D. You are asked to mix a batch of mortar using a 1:1:6 ratio, but you will need six times this amount. What will be the proportion of material needed?

Proportion = ____________________

E. A mixture of 1 part cement, 1 part lime, and 3 parts sand is needed to make 25 cubic feet of mortar. How many cubic feet of each are needed?

Cubic feet cement = ____________________

Cubic feet lime = ____________________

Cubic feet sand = ____________________

BASIC MATH
UNIT I

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

Part I

A. 11
B. 16
C. 13
D. 23
E. 108

F. 88
G. 242
H. 1538
I. 1917
J. 16,430

Part II

A. 1175 lineal feet
B. 1135 doors
C. $609
D. 12,130 square feet

Assignment Sheet #2

Part I

A. 4
B. 7
C. 53
D. 406
E. 424

F. 283
G. 1175
H. 1810
I. 51,450
J. 89,722

Part II

A. 126 studs
B. 1160 square feet
C. 4410 square feet
D. 14,145 studs

Assignment Sheet #3

Part I

A. 42
B. 72
C. 324
D. 2884
E. 8410

F. 2028
G. 21,291
H. 165,478
I. 503,605
J. 5,458,852

Part II

A. 68,383 pounds
B. 8160 square feet
C. 2850 square feet
D. 1440 hours

Assignment Sheet #4

Part I

A. 4
B. 8
C. 91
D. 312
E. 3

F. 3
G. 62, R 4
H. 2, R 97
I. 1, R 365
J. 3, R 634

Part II

A. 2070 square feet of flooring
B. 8 windows, 4 inches
C. $97\frac{1}{2}$ board feet
D. 68 sheets

Assignment Sheet #5

Part I

A.
  1. 5,8
  2. numerator, denominator
  3. 1,4

B.
  1. $\frac{10}{16}$
  2. $\frac{16}{32}$

C.
  1. 1
  2. 8
  3. $\frac{1}{8}$

ANSWERS TO ASSIGNMENT SHEETS

Part II

A.
1. n
2. d
3. f
4. k
5. a
6. j
7. i
8. l
9. b
10. g
11. m
12. c
13. h
14. o
15. e

B. Evaluated to the satisfaction of the instructor

Assignment Sheet #6

A. $\frac{1}{2}$
B. $\frac{1}{2}$
C. 1
D. $\frac{1}{4}$
E. $\frac{1}{4}$
F. $\frac{3}{8}$
G. $\frac{1}{2}$
H. $\frac{1}{2}$
I. $\frac{3}{4}$
J. $\frac{1}{2}$

Assignment Sheet #7

Part I

A. 4
B. 8
C. 3
D. 5
E. 3
F. 20
G. 18
H. 9
I. 6
J. 28
K. 3
L. 7

Part II

A. $\frac{6}{16}$ and $\frac{8}{16}$
B. $\frac{96}{128}$ and $\frac{36}{128}$
C. $\frac{8}{128}$ and $\frac{80}{128}$
D. $\frac{16}{32}$ and $\frac{14}{32}$
E. $\frac{1536}{2048}$ and $\frac{1152}{2048}$ and $\frac{448}{2048}$

Part III

A. $\frac{6}{20}$ and $\frac{5}{20}$
B. $\frac{32}{48}$ and $\frac{9}{48}$
C. $\frac{24}{32}$ and $\frac{9}{32}$
D. $\frac{8}{16}$ and $\frac{7}{16}$
E. $\frac{30}{40}$ and $\frac{25}{40}$ and $\frac{28}{40}$

Assignment Sheet #8

Part I

A.
1. P
2. M
3. I
4. M
5. P
6. I
7. I
8. M
9. I
10. M
11. M
12. I
13. I
14. P
15. M

B. Evaluated to the satisfaction of the instructor

C. Evaluated to the satisfaction of the instructor

Part II

A.
1. $\frac{13}{4}$
2. $\frac{9}{2}$
3. $\frac{31}{4}$
4. $\frac{17}{2}$
5. $\frac{49}{8}$
6. $\frac{11}{2}$
7. $\frac{17}{4}$
8. $\frac{17}{2}$
9. $\frac{37}{4}$
10. $\frac{33}{2}$

B.
1. $1\frac{3}{4}$
2. $4\frac{1}{2}$
3. $1\frac{1}{2}$
4. $1\frac{7}{8}$
5. $1\frac{3}{16}$
6. $1\frac{3}{8}$
7. $2\frac{11}{32}$
8. $2\frac{1}{2}$
9. $3\frac{3}{4}$
10. $2\frac{1}{16}$

Assignment Sheet #9

A. $\frac{1}{2}$
B. 1
C. $\frac{23}{32}$
D. $1\frac{3}{16}$
E. $\frac{29}{32}$
F. $1\frac{3}{16}$
G. $1\frac{5}{16}$
H. $1\frac{25}{32}$
I. $\frac{5}{8}$ gallon
J. $1\frac{3}{32}$ inches
K. $2\frac{1}{3}$ squares
L. $1\frac{3}{16}$ inches
M. $4\frac{3}{8}$ inches

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #10

A. $^{9}/_{16}$
B. $^{5}/_{8}$
C. $^{3}/_{16}$
D. $^{5}/_{32}$
E. $^{3}/_{4}$
F. $^{9}/_{16}$
G. $^{1}/_{16}$
H. $^{3}/_{8}$
I. $^{17}/_{32}$
J. $^{1}/_{2}$
K. $^{1}/_{2}$ inch
L. $^{17}/_{32}$ inch
M. $^{1}/_{8}$ inch
N. $23^{7}/_{64}$ inches
O. $1^{3}/_{4}$ inches

Assignment Sheet #11

A. $^{3}/_{8}$
B. $^{15}/_{128}$
C. $3^{3}/_{8}$
D. $3^{1}/_{4}$
E. $^{7}/_{12}$
F. $1^{1}/_{2}$
G. $^{1}/_{24}$
H. $16^{27}/_{32}$
I. $2^{1}/_{8}$ feet
J. $^{1}/_{4}$ gallon
K. 74 nails
L. $4^{1}/_{3}$ squares
M. $^{7}/_{8}$ inch

Assignment Sheet #12

A. 0.189
B. 1.072
C. $9.22
D. 0.0102
E. $71.01
F. $131.32
G. 287.706
H. 0.4000
I. 6.455
J. 30024.88
K. 56.000
L. 0.87139
M. $164.80
N. 27.9 hours
O. $122.71
P. 1366.6 miles
Q. 26.55 R

Assignment Sheet #13

A. 351.98
B. 547.144
C. 141.013
D. 508.16
E. $749.25
F. $4.15
G. 670.4
H. 4107.34
I. $2.47
J. $197.45
K. 603.7 miles
L. $1781.04
M. 0.0167 inch
N. $177.43
O. 1516.5 square feet

Assignment Sheet #14

A. 8.184
B. 39.6
C. 1.1475
D. 297.5
E. 100.32
F. 6.4584
G. 0.4565
H. 25.38
I. 0.00069
J. 22.6352
K. $337.45
L. $61,875.00
M. 24.975 feet
N. $132.62
O. 2079.375 pounds

Assignment Sheet #15

A. 9
B. 12.4
C. 33
D. 153
E. 1.5
F. 284
G. 0.8
H. 0.5
I. 300
J. 0.4
K. 2500
L. 1200
M. 12,000
N. 170
O. 14,000
P. $8.64
Q. 30.3 hours
R. 32 lots
S. $21.60
T. 0.75 hours

Assignment Sheet #16

Part I

A.
1. 0.125
2. 0.25
3. 0.5
4. 0.75
5. 0.625
6. 0.0625
7. 0.09375
8. 0.875
9. 0.5625
10. 0.9375

B.
1. 25%
2. 50%
3. 70%
4. 75%
5. 100%
6. 10%
7. 87.5%
8. 50%
9. 33.3%
10. 62.5%

PART II

A.
1. g
2. j
3. d
4. a
5. i
6. b
7. c
8. f
9. h
10. e

ANSWERS TO ASSIGNMENT SHEETS

B. 1. 63.9
2. 5.93
3. 5.093
4. 5.0093
5. 3.825
6. 38.95
7. 38.095
8. 42.3
9. 402.3
10. 897.00097

Part III

A. 1. 1/2
2. 1/4
3. 1/3
4. 9/25
5. 7/25
6. 1/7
7. 21/100
8. 3/4
9. 2/3
10. 7/10

B. 1. 0.47
2. 0.15
3. 0.333
4. 0.62
5. 0.75
6. 0.03
7. 0.168
8. 0.09
9. 0.10
10. 0.50

Assignment Sheet #17

Part I

A. All work is completed
B. 14%
C. 86, 86%
D. 25%, 5%
E. 94%
F. 6, 6%
G. 89%
H. 94%
I. 40%
J. 50%
K. 5%
L. 38%
M. 25%
N. 60%
O. 7%

Part I

A. 2.16
B. 0.9
C. 32
D. 50
E. 43.18
F. 17.6
G. 1.03
H. 57
I. 16.4
J. 11.41

Part II

A. 12
B. 1
C. $24.00
D. 600

Assignment Sheet #18

A. 1. 64 square inches
2. 256 square feet
3. 225 square feet
4. 1296 square yards

B. 1. 60 square feet
2. 192 square yards
3. 527 square inches
4. 992 square feet

C. 1. 113.04 square inches
2. 615.44 square feet
3. 803.84 square feet
4. 490.625 square yards

D. 1. 48 square inches
2. 199.5 square feet
3. 19.5 square inches
4. 180 square yards

E. 1. 12 square feet
2. 104 square yards
3. 256 square inches
4. 243 square yards

F. 1. 493 square inches
2. 242 square yards
3. 168 square feet
4. 765 square yards

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #19

Part I

(NOTE: Answers may be reversed in the width and length columns.)

	H	W	L	V
A.	3	3	2	18
B.	3	3	3	27
C.	2	3	3	18
D.	5	2	4	40
E.	3	2	2	12
F.	2	2	5	20
G.	1	2	3	6
H.	2	2	2	8
I.	3	2	3	18
J.	2	4	7	56

Part II

A. 4 cubes
B. 2 cubes
C. 2 layers
D. 6 cubes
E. 12 cubes
F. 12 cubic units
G. 12 cubes
H. 3 layers
I. Answers will vary
J. 1728 cubic inches
K. 144 cubic inches
L. 288 cubic inches
M. 432 cubic inches
N. 12 layers
O. 27 cubic feet

Part III

A. 60 cubic feet
B. 63 cubic inches
C. 20 cubic yards
D. 60 cubic inches
E. 64 cubic yards
F. 40 cubic feet

Assignment Sheet #20

A. 17.77 cubic yards
B. 3.259 cubic yards
C. 4.11 cubic yards
D. 18.88 cubic yards
E. 8.74 cubic yards

Assignment Sheet #21

A. 1:1:4
B. 0.5:1:6
C. 3:3:9
D. 6:6:36
E. 5 cubic feet cement
5 cubic feet lime
15 cubic feet sand

BASIC MATH
UNIT I

TEST

NAME ______________________________ SCORE ______________

1. Match to their correct definitions terms associated with basic math. Write the correct numbers in the blanks.

______a. To solve by mathematical process

______b. Process of totaling two or more numbers to find another number called a sum

______c. Fraction with an unwritten denominator of 10 or some power of 10; indicated with a point before the number

______d. Any one of the ten symbols, 0 to 9, by which all numbers can be expressed

______e. Opposite (inverse) operation of multiplication

______f. Part of a whole; represents one or more equal parts of a unit

______g. Any of the natural numbers, both positive and negative, that represents a complete item

______h. Pertaining to nominal units based on a 4-inch module

______i. Abbreviated process of adding a number to itself a specified number of times

______j. Theoretical size that may vary from the actual

______k. One part in a hundred; reckoned on the basis of a whole divided into one hundred parts

______l. Mathematical proposition

______m. Being relatively equal in size or quantity

______n. Relationship in quantity, amount, or size between two or more things

______o. Opposite (inverse) operation of addition

1. Digit
2. Multiplication
3. Problem
4. Nominal size
5. Subtraction
6. Whole number (integer)
7. Addition
8. Modular
9. Calculate
10. Fraction
11. Ratio
12. Proportional
13. Division
14. Decimal
15. Percent

TEST

2. Match to their correct names symbols used in math problems. Write the correct numbers in the blanks.

_____a. Plus sign (addition)

_____b. Pi sign

_____c. Equal sign

_____d. Division frame

_____e. Ratio symbol

_____f. Minus sign (subtraction)

_____g. Percent symbol

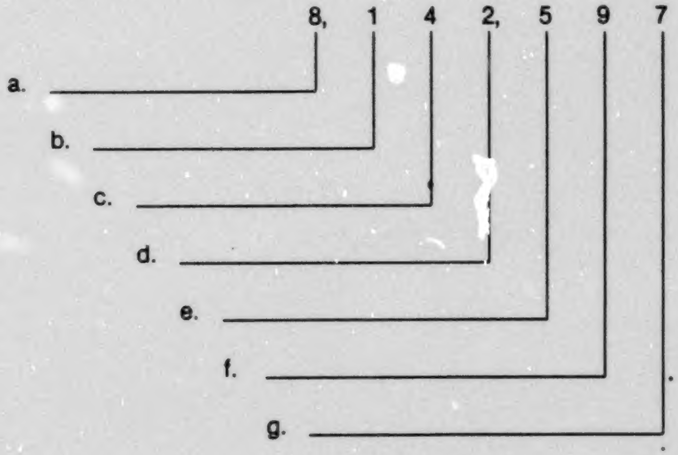
_____h. Times sign (multiplication)

_____i. Decimal point

_____j. Division sign

1. =
2. ×
3. −
4. ÷
5. +
6. .
7. π
8. %
9. :
10. $\overline{)\quad\quad}$

3. Label the place values in the whole number below.



TEST

4. Add whole numbers to solve the following problems. Show your work.

$$\begin{array}{lrlrlrlrlr}
\text{a.} & 2 & \text{b.} & 5 & \text{c.} & 12 & \text{d.} & 142 & \text{e.} & 2345 \\
 & \underline{+\ 9} & & 7 & & 17 & & 759 & & 9764 \\
 & & & \underline{+\ 8} & & \underline{+\ 99} & & \underline{+\ 896} & & \underline{+\ 8976}
\end{array}$$

5. Subtract whole numbers to solve the following problems. Check your answers and show your work.

$$\begin{array}{lrlrlrlrlr}
\text{a.} & 9 & \text{b.} & 35 & \text{c.} & 481 & \text{d.} & 684 & \text{e.} & 9867 \\
 & \underline{-\ 7} & & \underline{-\ 9} & & \underline{-\ 79} & & \underline{-\ 342} & & \underline{-\ 8748}
\end{array}$$

6. Multiply whole numbers to solve the following problems. Show your work.

$$\begin{array}{lrlrlrlrlr}
\text{a.} & 7 & \text{b.} & 68 & \text{c.} & 735 & \text{d.} & 649 & \text{e.} & 8673 \\
 & \underline{\times\ 5} & & \underline{\times\ 9} & & \underline{\times\ 68} & & \underline{\times\ 537} & & \underline{\times\ 642}
\end{array}$$

7. Divide whole numbers to solve the following problems. Show your work.

a. $4\overline{)48}$ b. $16\overline{)64}$ c. $38\overline{)608}$

TEST

d. $421\overline{)842}$

e. $317\overline{)4569}$

f. $530\overline{)80960}$

8. Distinguish among types of fractions. Write a "P" in the blanks before proper fractions, an "I" before improper fractions, and an "M" in the blanks before mixed numbers.

______a. $\frac{1}{2}$

______b. $8\frac{3}{4}$

______c. $\frac{8}{8}$

______d. $15\frac{3}{8}$

______e. $5\frac{3}{16}$

______f. $\frac{10}{32}$

______g. $\frac{2}{8}$

______h. $6\frac{1}{2}$

______i. $\frac{1}{4}$

______j. $\frac{99}{1}$

9. Reduce the following fractions to lowest terms. Write your answers in the blanks.

__________a. $\frac{4}{8}$

__________b. $\frac{8}{16}$

__________c. $\frac{7}{16}$

__________d. $\frac{8}{32}$

__________e. $\frac{12}{32}$

__________f. $\frac{4}{16}$

__________g. $\frac{2}{16}$

__________h. $\frac{8}{64}$

__________i. $\frac{12}{16}$

__________j. $\frac{31}{32}$

10. Convert the following mixed numbers to improper fractions. Reduce to lowest terms if possible. Write your answers in the blanks.

__________a. $3\frac{1}{2}$

__________b. $4\frac{2}{4}$

__________c. $3\frac{6}{8}$

__________d. $12\frac{4}{8}$

__________e. $13\frac{13}{32}$

TEST

11. Convert the following improper fractions to mixed numbers. Reduce answers to lowest terms. Write your answers in the blanks.

__________a. $\frac{47}{8}$

__________b. $\frac{21}{9}$

__________c. $\frac{108}{23}$

__________d. $\frac{54}{5}$

__________e. $\frac{112}{7}$

12. Add fractions to solve the following problems. Convert to mixed numbers if necessary, and reduce to lowest terms. Write your answers in the blanks.

__________a. $\frac{1}{8} + \frac{5}{8}$

__________b. $\frac{1}{16} + \frac{15}{16}$

__________c. $\frac{2}{4} + \frac{3}{4}$

__________d. $\frac{1}{2} + \frac{4}{8}$

__________e. $\frac{4}{8} + \frac{2}{4}$

__________f. $\frac{7}{8} + \frac{6}{16}$

__________g. $2\frac{1}{8} + 7\frac{1}{4}$

__________h. $3\frac{2}{4} + 16\frac{1}{8}$

__________i. $4\frac{2}{4} + 8\frac{2}{8}$

__________j. $5\frac{1}{8} + 6\frac{2}{16}$

13. Subtract fractions to solve the following problems. Reduce answers to lowest terms. Write your answers in the blanks.

__________a. $\frac{4}{8} - \frac{3}{8}$

__________b. $\frac{6}{8} - \frac{2}{8}$

__________c. $\frac{9}{16} - \frac{4}{16}$

__________d. $\frac{3}{8} - \frac{1}{4}$

__________e. $\frac{3}{8} - \frac{1}{8}$

__________f. $\frac{14}{16} - \frac{7}{8}$

__________g. $2\frac{3}{4} - 1\frac{1}{4}$

__________h. $6\frac{1}{8} - 2\frac{1}{2}$

__________i. $9\frac{2}{4} - 4\frac{1}{2}$

__________j. $12\frac{6}{8} - 7\frac{1}{8}$

TEST

14. Multiply fractions to solve the following problems. Reduce to lowest terms. Write your answers in the blanks.

____________a. $\frac{1}{2} \times \frac{3}{4}$

____________b. $\frac{3}{4} \times \frac{3}{8}$

____________c. $\frac{3}{2} \times \frac{1}{16}$

____________d. $\frac{3}{4} \times 6\frac{1}{2}$

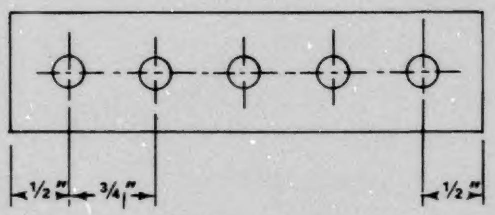
____________e. $6\frac{3}{4} \times 8\frac{3}{4}$

____________f. $7\frac{1}{8} \times 1\frac{1}{2}$

____________g. $\frac{77}{16} \times 5$

____________h. A piece of shoe mold is 15 feet long. Someone cut off 1/20 of its total length. How long is the cut piece? (Convert your answer to inches.)

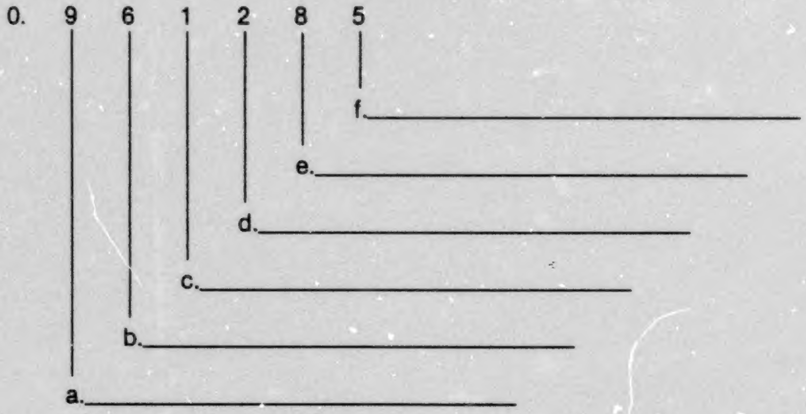
____________i. The bolt template illustrated below is to be drilled with 5 holes equally spaced. Find the length of the template.



____________j. Two trucks are used to haul crushed rock. The larger truck hauls 3 1/2 cubic yards per load, and the other hauls 2 1/4 cubic yards per load. If each truck hauls 16 loads, what is the total quantity in cubic yards of crushed rock hauled?

TEST

15. Label the place values in the decimal number below.



16. Add decimal numbers to solve the following problems. Set up each problem and show your work. Write your answers in the blanks.

__________a. 3.5 + 5.1 + 7

__________b. 3.4 + 0.206 + 1.74

__________c. \$6.86 + \$5.05 + \$7.90 + \$.82

__________d. 57.78 + 0.22 + 0.003 + 74

__________e. 6319 + 95.12 + 0.0713 + 321.07

TEST

17. Subtract decimal numbers to solve the following problems. Set up each problem and check your work. Write your answers in the blanks.

____________a. $6.10 – $2.20

____________b. $5.40 – $2.32

____________c. $7.38 – $.63

____________d. 0.835325 – 0.25

____________e. 0.609375 – 0.359375

18. Multiply decimal numbers to solve the following problems. Set up each problem and show your work. Write your answers in the blanks.

____________a. 2.6 × 4.7

____________b. 0.119 × 0.05

TEST

__________c. 9 × 0.08

__________d. 7.392 × 92.07

__________e. 9.5 × 0.76

19. Divide decimals to solve the following problems. Set up each problem and check your work. Write your answers in the blanks.

__________a. 5.32 ÷ 0.4

__________b. 83.4 ÷ 0.6

__________c. 7.75 ÷ 0.25

TEST

__________ d. 0.921 ÷ 0.3

__________ e. 0.0225 ÷ 0.15

__________ f. 24 ÷ 0.2

__________ g. 54 ÷ 0.09

__________ h. 63 ÷ 0.007

__________ i. 812 ÷ 0.058

TEST

__________ j. $4215 \div 0.040$

20. Convert the following fractions to decimal numbers and percentages. Give percentages in the nearest whole percent. Write your answers in the blanks.

Decimal Number	Percentage	
__________	__________	a. $^{1}/_{3}$
__________	__________	b. $^{3}/_{25}$
__________	__________	c. $23\,^{3}/_{100}$
__________	__________	d. $11\,^{24}/_{1000000}$
__________	__________	e. $^{7}/_{16}$
__________	__________	f. $^{2}/_{7}$
__________	__________	g. $8\,^{13}/_{100000}$
__________	__________	h. $^{5}/_{8}$
__________	__________	i. $18\,^{3}/_{10}$
__________	__________	j. $5\,^{5}/_{1000}$

TEST

21. Identify decimal and fractional equivalents. Write the correct answers in the blanks.

1/64	.015625
1/32	.03125
3/64	.046875
1/16	.0625
5/64	.078125
3/32	.09375
7/64	.109375
a. ____	**.125**
9/64	.140625
5/32	.15625
11/64	.171875
3/16	.1875
13/64	.203125
7/32	.21875
15/64	.234375
1/4	b. ____
17/64	.265625
9/32	.28125
19/64	.296875
5/16	.3125
21/64	.328125
11/32	.34375
23/64	.359375
c. ____	**.375**
25/64	.390625
13/32	.40625
27/64	.421875
7/16	.4375
29/64	.453125
15/32	.46875
31/64	.484375
1/2	d. ____
33/64	.515625
17/32	.53125
35/64	.546875
9/16	.5625
37/64	.578125
19/32	.59375
39/64	.609375
5/8	e. ____
41/64	.640625
21/32	.65625
43/64	.671875
11/16	.6875
45/64	.703125
23/32	.71875
47/64	.734375
f. ____	**.75**
49/64	.765625
25/32	.78125
51/64	.796875
13/16	.8125
53/64	.828125
27/32	.84375
55/64	.859375
7/8	g. ____
57/64	.890625
29/32	.90625
59/64	.921875
15/16	.9375
61/64	.953125
31/32	.96875
63/64	.984375
1	h. ____

TEST

22. Convert the following percentages to fractions and decimal numbers. Write your answers in the blanks.

Decimal Number	Fraction	
__________	__________	a. 12%
__________	__________	b. 30%
__________	__________	c. 45%
__________	__________	d. 72%
__________	__________	e. 250%

23. Solve the following percentage problems. Write your answers in the blanks.

__________a. If a contractor paid a bricklayer $150.00, which is 87 percent of his salary, how much more money would the bricklayer have coming?

__________b. If 12 percent of the bricks for a job are stolen, how many bricks will be left of the 2100 stored for the job?

__________c. If a contractor bought a forklift for $24,000, and sold it for $30,000, what was her percentage of profit?

TEST

24. Match terms used in geometry to their correct definitions. Write the correct numbers in the blanks.

_____a. Volume of an object that is 1 foot long, 1 foot wide, and 1 foot high

_____b. Shape formed by straight or curved lines

_____c. Line or surface at a right angle to another line or surface

_____d. Outer limits or boundary

_____e. Greek letter (π) representing the ratio of a circle's circumference to its diameter; ratio approximately 3.1416

_____f. Distance around outer edge of a circle

_____g. Distance between outer edges of circle through center point

_____h. Measure of a flat surface; expressed in square units

_____i. Line from center of a circle to any point on edge of circle

_____j. Relating to, consisting of, or resembling a straight line

_____k. Extending in the same direction; equal distance apart and never meeting

_____l. Space occupied by a body; expressed in cubic units

_____m. Angle formed by two lines perpendicular to each other; 90-degree angle

_____n. Unit with three equal dimensions, including length, width, and height

1. Perimeter
2. Radius
3. Volume
4. Lineal
5. Parallel
6. Diameter
7. Geometric figure
8. Area
9. Cubic foot
10. Circumference
11. Cubic unit
12. Right angle
13. Pi
14. Perpendicular

TEST

25. Match types of geometric figures to their correct descriptions. Write the correct numbers in the blanks.

______a. Figure having three sides and three angles

______b. Figure having four sides of equal length and four right angles

______c. Flat, round figure formed by one curved line; all points of curved line are equidistant from center point

______d. Figure having no right angles and four sides of equal length

______e. Figure with only one pair of parallel opposite sides

______f. Figure with two parallel ends of equal length, two parallel sides of equal length, and four right angles

______g. Figure such as a square, rectangle, or rhombus with two parallel ends of equal length and two parallel sides of equal length

1. Circle
2. Parallelogram
3. Trapezoid
4. Triangle
5. Rectangle
6. Rhombus
7. Square

26. Match units of measure to their correct equivalents. Write the correct numbers in the blanks.

______a. Equal to five thousand, two hundred and eighty feet (5280′)

______b. Equal to one-twelfth of a foot ($^1/_{12}$′) or one thirty-sixth of a yard ($^1/_{36}$ yard)

______c. Equal to three feet (3′) or thirty-six inches (36″)

______d. Equal to $^1/_{360}$ of a circle

______e. Equal to sixteen and one-half feet (16$^1/_2$′)

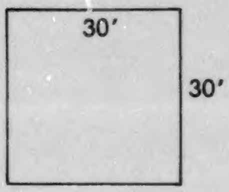
______f. Equal to twelve inches (12″) or one-third of a yard ($^1/_3$ yard)

1. Inch (″)
2. Foot (′)
3. Yard
4. Rod
5. Mile
6. Degree (°)

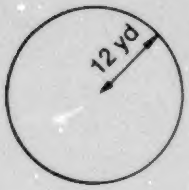
TEST

27. Calculate the area of each of the following geometric figures. Show your work. Write the correct answers in the blanks.

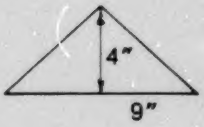
__________ a.



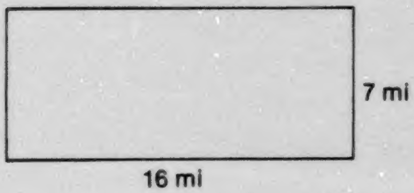
__________ b.



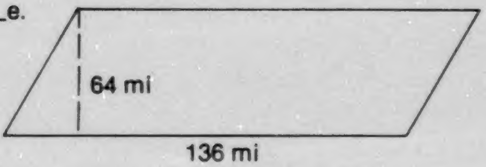
__________ c.



__________ d.

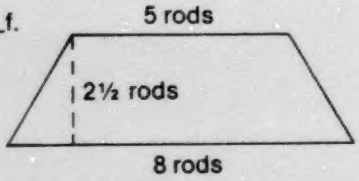


__________ e.



TEST

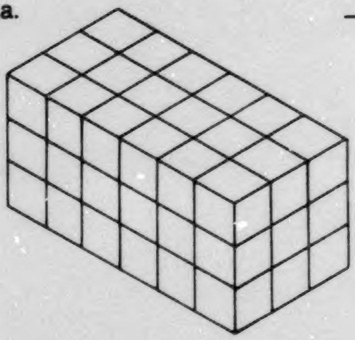
__________f.


5 rods
2½ rods
8 rods

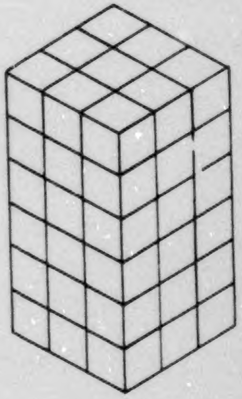
28. Calculate volume of the following solid figures. Write the correct answers in the blanks.

Counting

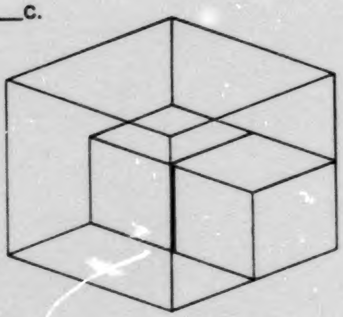
__________a.



__________b.

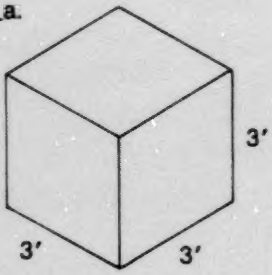


__________c.

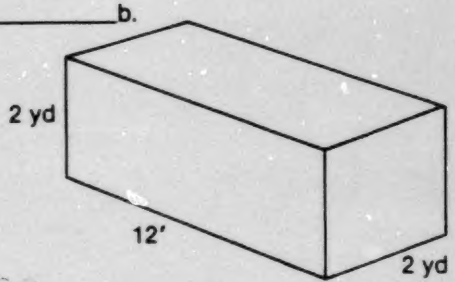


Using formula and converting as necessary

__________a.

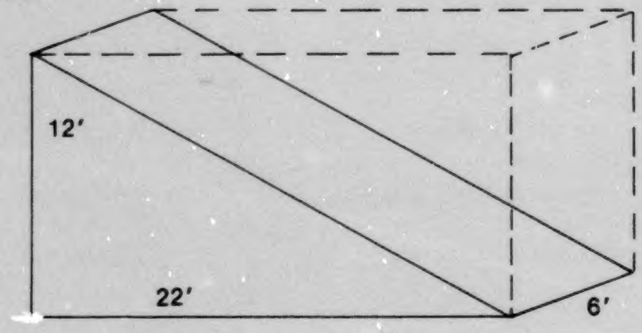


__________b.



TEST

__________c.



__________d. How much fill will it take to fill an area 43 feet long, 36 feet wide, and 6 inches high?

__________e. How much sand will it take to fill the bed of a truck 3 feet deep, 8½ feet wide, and 12 feet long?

__________f. What would be the volume of a form 12 inches high, 72 inches long, and 36 inches wide?

__________g. How many cubic yards of sand are needed to fill an area 12 feet wide, 144 feet long, and 12 inches deep?

TEST

29. Solve the following basic ratio and proportion problems. Write your answers in the blanks.

__________ a. Convert the ratio 0.5:0.5:2 to the smallest whole-number proportion.

__________ b. Convert the ratio 1:1:3 to a decimal proportion.

__________ c. What would be the proportion if a mix of 2.5:2.5:5 were doubled?

__________ d. What would be the proportion if a 3:3:12 mix were cut to one-third?

__________ e. If a mixture of 2 parts cement, 4 parts lime, and 6 parts sand were needed to do a job, what would the proportion be?

f. Referring to problem e, how many cubic feet of each proportion would it take to make 36 cubic feet of mortar?

Cubic feet cement __________

Cubic feet lime __________

Cubic feet sand __________

BASIC MATH
UNIT I

ANSWERS TO TEST

1. a. 9
b. 7
c. 14
d. 1
e. 13
f. 10
g. 6
h. 8
i. 2
j. 4
k. 15
l. 3
m. 12
n. 11
o. 5

2. a. 5
b. 7
c. 1
d. 10
e. 9
f. 3
g. 8
h. 2
i. 6
j. 4

3. a. Millions
b. Hundred thousands
c. Ten thousands
d. Thousands
e. Hundreds
f. Tens
g. Units

4. a. 11
b. 20
c. 128
d. 1797
e. 21,085

5. a. 2
b. 26
c. 402
d. 342
e. 1119

6. a. 35
b. 612
c. 49,980
d. 348,513
e. 5,568,066

7. a. 12
b. 4
c. 16
d. 2
e. 14, R 131
f. 152, R 400

8. a. P
b. M
c. I
d. M
e. M
f. P
g. P
h. M
i. P
j. I

9. a. $^{1}/_{2}$
b. $^{1}/_{2}$
c. $^{7}/_{16}$
d. $^{1}/_{4}$
e. $^{3}/_{8}$
f. $^{1}/_{4}$
g. $^{1}/_{8}$
h. $^{1}/_{8}$
i. $^{3}/_{4}$
j. $^{31}/_{32}$

10. a. $^{7}/_{2}$
b. $^{9}/_{2}$
c. $^{15}/_{4}$
d. $^{25}/_{2}$
e. $^{429}/_{32}$

11. a. $5^{7}/_{8}$
b. $2^{1}/_{3}$
c. $4^{16}/_{23}$
d. $10^{4}/_{5}$
e. 16

12. a. $^{3}/_{4}$
b. 1
c. $1^{1}/_{4}$
d. 1
e. 1
f. $1^{1}/_{4}$
g. $9^{3}/_{8}$
h. $19^{5}/_{8}$
i. $12^{3}/_{4}$
j. $11^{1}/_{4}$

13. a. $^{1}/_{8}$
b. $^{1}/_{2}$
c. $^{5}/_{16}$
d. $^{1}/_{8}$
e. $^{1}/_{4}$
f. 0
g. $1^{1}/_{2}$
h. $3^{5}/_{8}$
i. 5
j. $5^{5}/_{8}$

ANSWERS TO TEST

14. a. $\frac{3}{8}$
    b. $\frac{9}{32}$
    c. $\frac{3}{32}$
    d. $4\frac{7}{8}$
    e. $59\frac{1}{16}$
    f. $10\frac{11}{16}$
    g. $24\frac{1}{16}$
    h. 9 inches
    i. 4 inches
    j. 92 cubic yards

15. a. Tenths
    b. Hundredths
    c. Thousandths
    d. Ten thousandths
    e. Hundred thousandths
    f. Millionths

16. a. 15.6
    b. 5.346
    c. $20.63
    d. 132.003
    e. 6735.2613

17. a. $3.90
    b. $3.08
    c. $6.75
    d. 0.585325
    e. 0.25

18. a. 12.22
    b. 0.00595
    c. 0.72
    d. 680.58144
    e. 7.22

19. a. 13.3
    b. 139
    c. 31
    d. 3.07
    e. 0.15
    f. 120
    g. 600
    h. 9000
    i. 14,000
    j. 105,375

20. a. 0.3333; 33%
    b. 0.12; 12%
    c. 23.03; 2303%
    d. 11.000024; 1100%
    e. 0.4375; 44%
    f. 0.2857;29%
    g. 8.00013; 800%
    h. 0.8333; 83%
    i. 18.3; 1830%
    j. 5.005;501%

21. a. $\frac{1}{8}$
    b. .25
    c. $\frac{3}{8}$
    d. .5
    e. 6.25
    f. $\frac{3}{4}$
    g. .875
    h. 1

22. a. 0.12; $\frac{3}{25}$
    b. 0.30; $\frac{3}{10}$
    c. 0.45; $\frac{9}{20}$
    d. 0.72; $\frac{18}{25}$
    e. 2.50; $2\frac{1}{2}$

23. a. $22.41
    b. 1848 bricks
    c. 20 percent

24. a. 9
    b. 7
    c. 14
    d. 1
    e. 13
    f. 10
    g. 6
    h. 8
    i. 2
    j. 4
    k. 5
    l. 3
    m. 12
    n. 11

25. a. 4
    b. 7
    c. 1
    d. 6
    e. 3
    f. 5
    g. 2

26. a. 5
    b. 1
    c. 3
    d. 6
    e. 4
    f. 2

27. a. 900 square feet
    b. 452.16 square yards
    c. 18 square inches
    d. 112 square miles
    e. 8704 square miles
    f. $16\frac{1}{4}$ square rods

28. **Counting**

    a. 54 cubic units
    b. 54 cubic units
    c. 8 cubic units

ANSWERS TO TEST

Using formula and converting as necessary

- a. 27 cubic feet or 1 cubic yard
- b. 16 cubic yards
- c. 792 cubic feet or $29\frac{1}{3}$ cubic yards
- d. 756 cubic feet or 28 cubic yards
- e. 306 cubic feet or $11\frac{1}{3}$ cubic yards
- f. 31,104 cubic inches or 18 cubic feet
- g. 64 cubic yards

29.
- a. 1:1:4
- b. 0.33:0.33:1 or any other proportional decimal
- c. 5:5:10
- d. 1:1:4
- e. 2:4:6
- f. 6 cubic feet of cement, 12 cubic feet of lime, 18 cubic feet of sand

MEASURING
UNIT II

UNIT OBJECTIVE

After completing this unit, the student should be able to read rules and accurately measure objects. The student will show this knowledge by completing assignment sheets, job sheet, and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match to their correct definitions terms associated with measuring.
2. Identify basic measuring tools used by carpenters.
3. List common errors that contribute to incorrect measurements.
4. Identify graduations on a carpenter's rule.
5. Read a carpenter's rule to the nearest fraction of an inch.
6. Convert fractional inches to hundredths of a foot.
7. Identify graduations on an engineer's rule.
8. Read an engineer's rule to the nearest hundredth of a foot.
9. Identify graduations on a tape.
10. Read a tape to the nearest fraction of an inch.
11. Discuss measuring methods used to square lines.
12. Measure objects.
13. Demonstrate the ability to use basic measuring tools and the 3-4-5 method to lay out the perimeter of a building on a concrete slab.

MEASURING
UNIT II

SUGGESTED ACTIVITIES

I. Unit contents

  A. Objective sheet

  B. Suggested activities

    1. Supplement #1 — Measuring Terms Word Search

    2. Transparency masters

      a. TM #1 — Graduations on a Carpenter's Rule

      b. TM #2 — Graduations on a Carpenter's Rule (Continued)

      c. TM #3 — Graduations on an Engineer's Rule

      d. TM #4 — Reading Fourths on a Carpenter's Rule

      e. TM #5 — Reading Eighths on a Carpenter's Rule

      f. TM #6 — Reading Sixteenths on a Carpenter's Rule

  C. Information sheet

  D. Assignment sheets

    1. Assignment Sheet #1 — Read Measurements on Carpenter's and Engineer's Rules

    2. Assignment Sheet #2 — Measure Objects

    3. Assignment Sheet #3 — Convert Fractional Inches to Hundredths of a Foot

    4. Assignment Sheet #4 — Read Measurements on Tapes

  E. Answers to assignments sheets

  F. Job Sheet #1 — Use Basic Measuring Tools and the 3-4-5 Method to Lay Out the Perimeter of a Building on a Concrete Slab

  G. Test

  H. Answers to test

SUGGESTED ACTIVITIES

II. Instructor's guide

A. Review unit and plan presentation.

B. Obtain materials to supplement unit.

   1. Carpenter's rules, engineer's rules, and tapes for each class member

   2. Several pieces of lumber or metal of different lengths

   3. Equipment and materials needed to perform procedures outlined in assignment and job sheets

   4. Transparencies and competency profiles

   (NOTE: Transparencies and competency profiles for this unit are available from the Oklahoma State Department of Vocational and Technical Education, Curriculum and Instructional Materials Center, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074, or The Associated General Contractors of America, 1957 E Street N.W., Washington, D.C. 20006. Phone: 202-393-2040.)

C. Make additional transparencies and copies of the supplements as desired.

D. Introduce unit to students.

E. Provide students with objective sheet.

F. Discuss unit and specific objectives, emphasizing how important measuring is to the carpentry trade and pointing out the importance of knowing how to read and use rules, tapes, and squares accurately.

G. Provide students with information, assignment, and job sheets.

H. Discuss information, assignment, and job sheets.

   1. Use Information Sheet, Section I to discuss terms associated with measuring.

   SUGGESTIONS:

   - Use the chalkboard and actual items to supplement your explanation of each term.
   - Have students review terms by completing Supplement #1.

   2. Use Information Sheet, Section II to discuss basic measuring tools used by carpenters.

   SUGGESTIONS:

   - Obtain actual measuring tools and have students identify them.

SUGGESTED ACTIVITIES

- Make flash cards containing pictures of the tools. Have students play games using the flash cards.
- Discuss the importance of purchasing and using quality tools.

3. Use Information Sheet, Section III to discuss common errors that contribute to incorrect measurements. Encourage students to double-check all measurements and math calculations.

4. Use Information Sheet, Section IV to discuss graduations on a carpenter's rule.

SUGGESTIONS:

- Provide each student with a carpenter's rule.
- Use Transparencies #1 and #2 to illustrate graduations on a carpenter's rule.
- Have students work in teams of two; have one team member point out various graduations on the carpenter's rule for the other to identify.

5. Use Information Sheet, Section V to discuss reading a carpenter's rule to the nearest fraction of an inch.

SUGGESTIONS:

- Provide each student with a carpenter's rule graduated in sixteenths.
- Use Transparencies #4 through #6 to illustrate the fourths, eighths, and sixteenths markings on the rule.
- Have students use the carpenter's rule to measure and record the lengths of several pieces of lumber or metal.
- Have students practice reading a carpenter's rule to the nearest fraction of an inch by completing Part I of Assignment Sheets #1 and #2.

6. Use Information Sheet, Section VI to discuss converting fractional inches to hundredths of a foot.

SUGGESTIONS:

- Have students memorize the three steps in the conversion process outlined in the information sheet. Emphasize how easy this method is and how quickly fractions and inches can be converted once the method is learned.

SUGGESTED ACTIVITIES

- Have students review the section on converting fractions in Unit I, "Basic Math."
- Make flash cards with fractional inches on one side and the correct hundredths conversion on the other side. Have students team up to practice converting fractional inches to hundredths of a foot.
- Have students practice converting fractional inches to hundredths of a foot by completing Assignment Sheet #3.

7. Use Information Sheet, Section VII to discuss graduations on an engineer's rule.

SUGGESTIONS:

- Provide each student with an engineer's rule.
- Use Transparency #3 to illustrate graduations on an engineer's rule.
- Have students work in teams of two; have one team member point out various graduations on the engineer's rule for the other to identify.

8. Use Information Sheet, Section VIII to discuss reading an engineer's rule to the nearest hundredth of a foot.

SUGGESTIONS:

- Provide each student with an engineer's rule.
- Have students use the engineer's rule to measure and record the lengths of the pieces of lumber or metal gathered for Section V. Compare their measurements, and explain the importance of converting from inches to hundredths or from hundredths to inches.
- Have students practice reading an engineer's rule to the nearest hundredth of a foot by completing Part II of Assignment Sheets #1 and #2.
- Draw lines on poster board or on the floor. Have students practice measuring the lines.

9. Use Information Sheet, Sections IX and X to discuss graduations on a tape and reading a tape to the nearest fraction of an inch.

SUGGESTIONS:

- Provide each student with a tape.
- Have students use procedures outlined in the information sheet to complete Assignment Sheet #4.

SUGGESTED ACTIVITIES

- Have students practice measuring the lengths and widths of the classroom, the shop, the building, and so on.
- Provide a practice exercise in which students have to make general measurements within a specified time.
- Discuss and demonstrate procedures outlined in Job Sheet #1, using the floor plan furnished with the job sheet. Have students measure and lay out interior dimensions and partition walls if desired.
- If necessary, review Unit III, "Plan Reading," before having students complete Job Sheet #1.

10. Use Information Sheet, Section XI and Job Sheet #1 to explain and demonstrate the 3-4-5 and diagonal methods used to square lines.

I. Give test.

J. Critique test and discuss in class.

K. Reteach and retest as necessary.

L. Complete appropriate section of competency profiles.

III. Unit references

A. Hendrix, Laborn J., "Bud." *Bricklaying Curriculum, Basic Core.* Stillwater, Oklahoma: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and The Associated General Contractors of America, 1983.

B. Hendrix, Laborn J., "Bud." *Commercial Carpentry Curriculum Material.* Stillwater, Oklahoma: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and The Associated General Contractors of America, 1979.

C. McDonnell, Leo P. *Hand Woodworking Tools.* Albany, New York: Delmar Publishers, 1962.

D. *Stanley Tool Guide.* New Britain, Connecticut: Stanley Works, Stanley Tools Division, Educational Department, 1972.

SUGGESTED ACTIVITIES

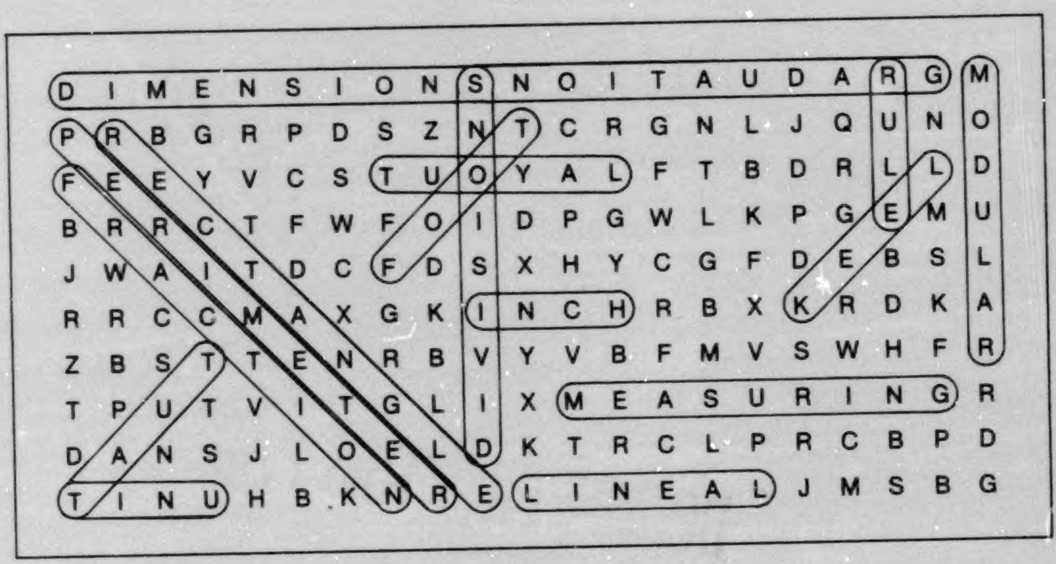
SUPPLEMENT #1 — MEASURING TERMS WORD SEARCH

The following measuring terms are hidden in the puzzle below. Find and circle each term. Words may be spelled forward, backward, from top to bottom, or diagonally. A score of 8 is good, 10 is excellent, and 15 is super. Solution to word search is given on the following page.

DIMENSIONS
DIVISIONS
FOOT
FRACTION
GRADUATIONS
INCH
KEEL
LAYOUT
LINEAL
MEASURING
MODULAR
PERIMETER
RECTANGLE
RULE
TAUT
UNIT

D	I	M	E	N	S	I	O	N	S	N	O	I	T	A	U	D	A	R	G	M
P	R	B	G	R	P	D	S	Z	N	T	C	R	G	N	L	J	Q	U	N	O
F	E	E	Y	V	C	S	T	U	O	Y	A	L	F	T	B	D	R	L	L	D
B	R	R	C	T	F	W	F	O	I	D	P	G	W	L	K	P	G	E	M	U
J	W	A	I	T	D	C	F	D	S	X	H	Y	C	G	F	D	E	B	S	L
R	R	C	C	M	A	X	G	K	I	N	C	H	R	B	X	K	R	D	K	A
Z	B	S	T	T	E	N	R	B	V	Y	V	B	F	M	V	S	W	H	F	R
T	P	U	T	V	I	T	G	L	I	X	M	E	A	S	U	R	I	N	G	R
D	A	N	S	J	L	O	E	L	D	K	T	R	C	L	P	R	C	B	P	D
T	I	N	U	H	B	K	N	R	E	L	I	N	E	A	L	J	M	S	B	G

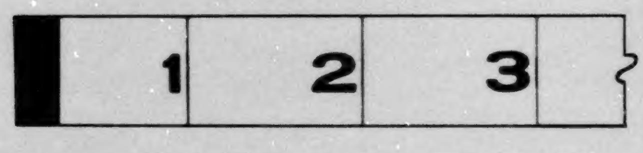
ANSWERS TO SUPPLEMENT #1



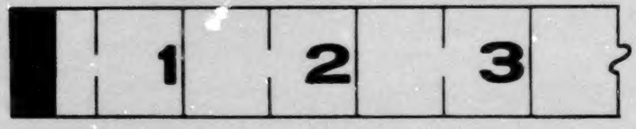
D	I	M	E	N	S	I	O	N	S	N	O	I	T	A	U	D	A	R	G	M
P	R	B	G	R	P	D	S	Z	N	T	C	R	G	N	L	J	Q	U	N	O
F	E	E	Y	V	C	S	T	U	O	Y	A	L	F	T	B	D	R	L	L	D
B	R	R	C	T	F	W	F	O	I	D	P	G	W	L	K	P	G	E	M	U
J	W	A	I	T	D	C	F	D	S	X	H	Y	C	G	F	D	E	B	S	L
R	R	C	C	M	A	X	G	K	I	N	C	H	R	B	X	K	R	D	K	A
Z	B	S	T	T	E	N	R	B	V	Y	V	B	F	M	V	S	W	H	F	R
T	P	U	T	V	I	T	G	L	I	X	M	E	A	S	U	R	I	N	G	R
D	A	N	S	J	L	O	E	L	D	K	T	R	C	L	P	R	C	B	P	D
T	I	N	U	H	B	K	N	R	E	L	I	N	E	A	L	J	M	S	B	G

Graduations on a Carpenter's Rule

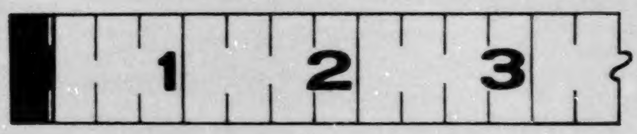
Inches



Halves



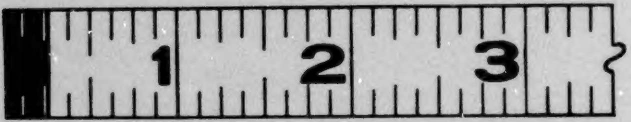
Quarters or Fourths



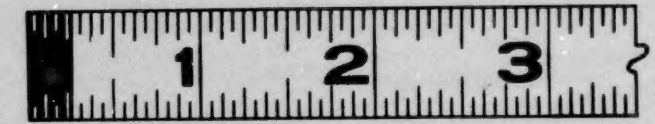
Graduations on a Carpenter's Rule

(Continued)

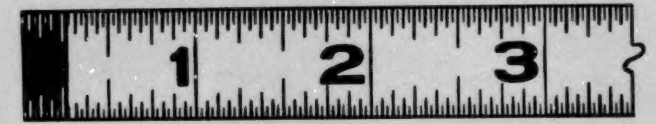
Eighths



Sixteenths

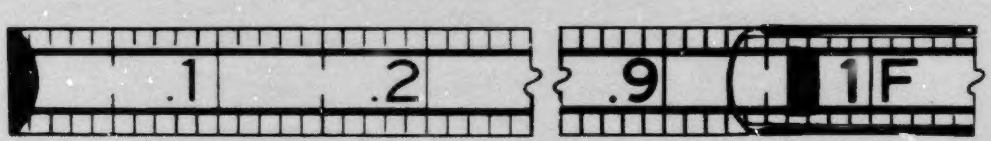


Thirty-Seconds

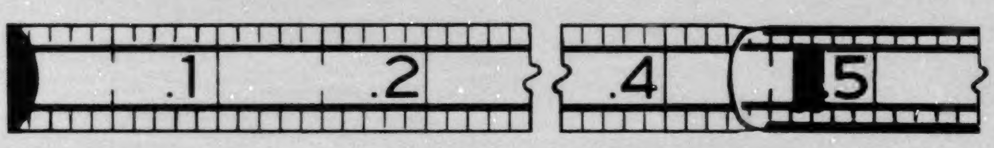


Graduations on an Engineer's Rule

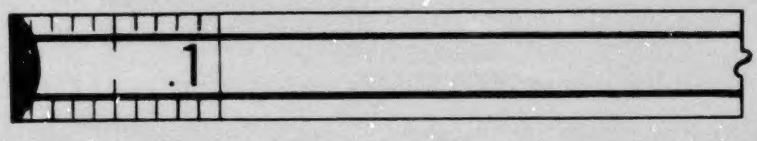
Ten 10ths equal 1 foot.



Five 10ths equal 6 inches or 1/2 foot.

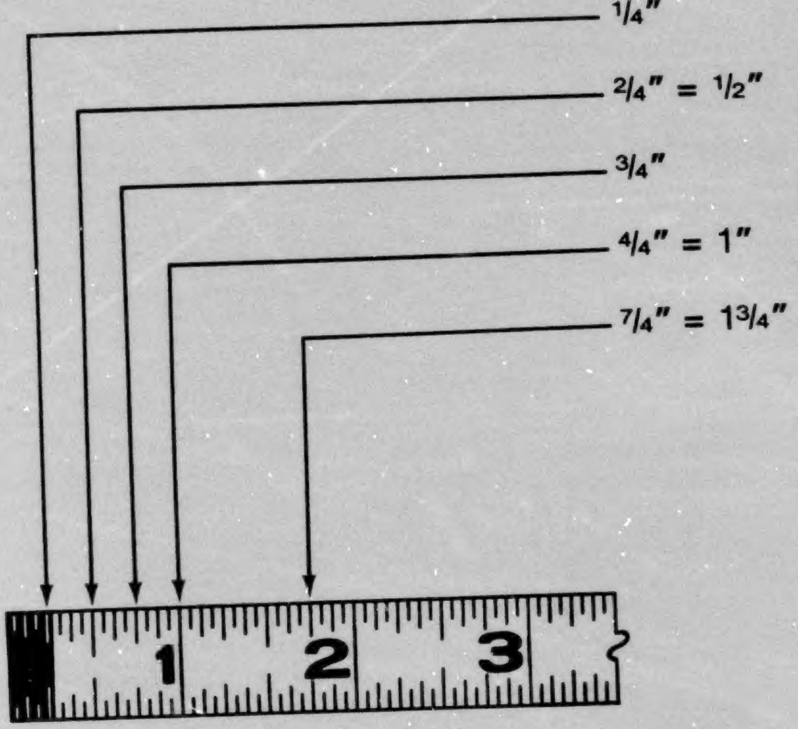


One 10th equals 1/10 of a foot or ten 100ths.

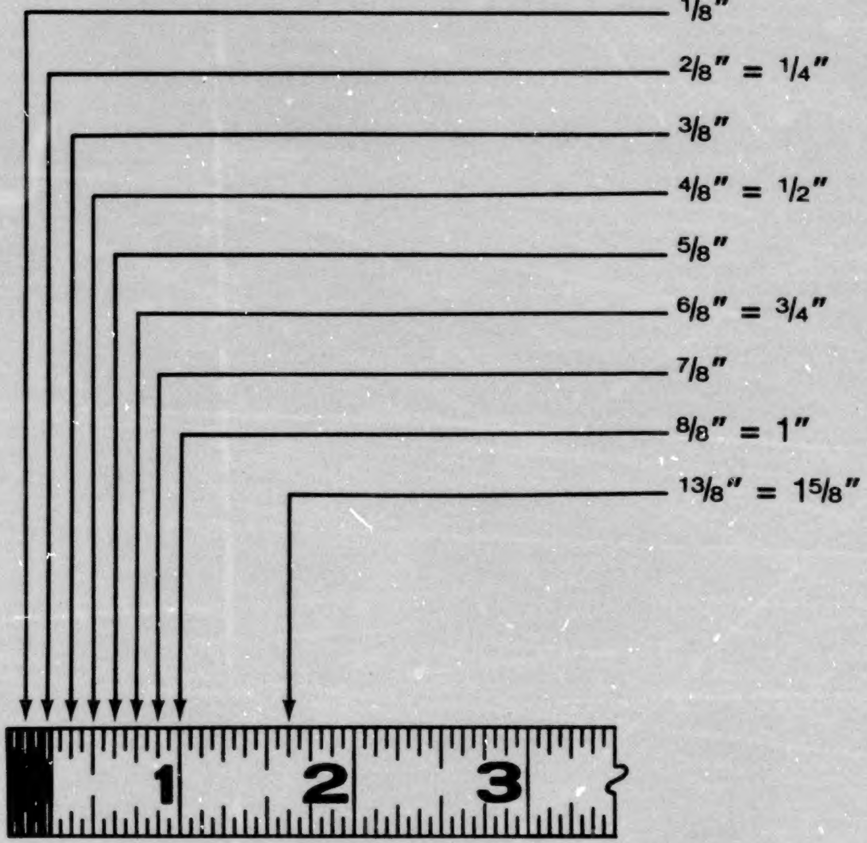


One 100th equals 1/10 of a 10th.

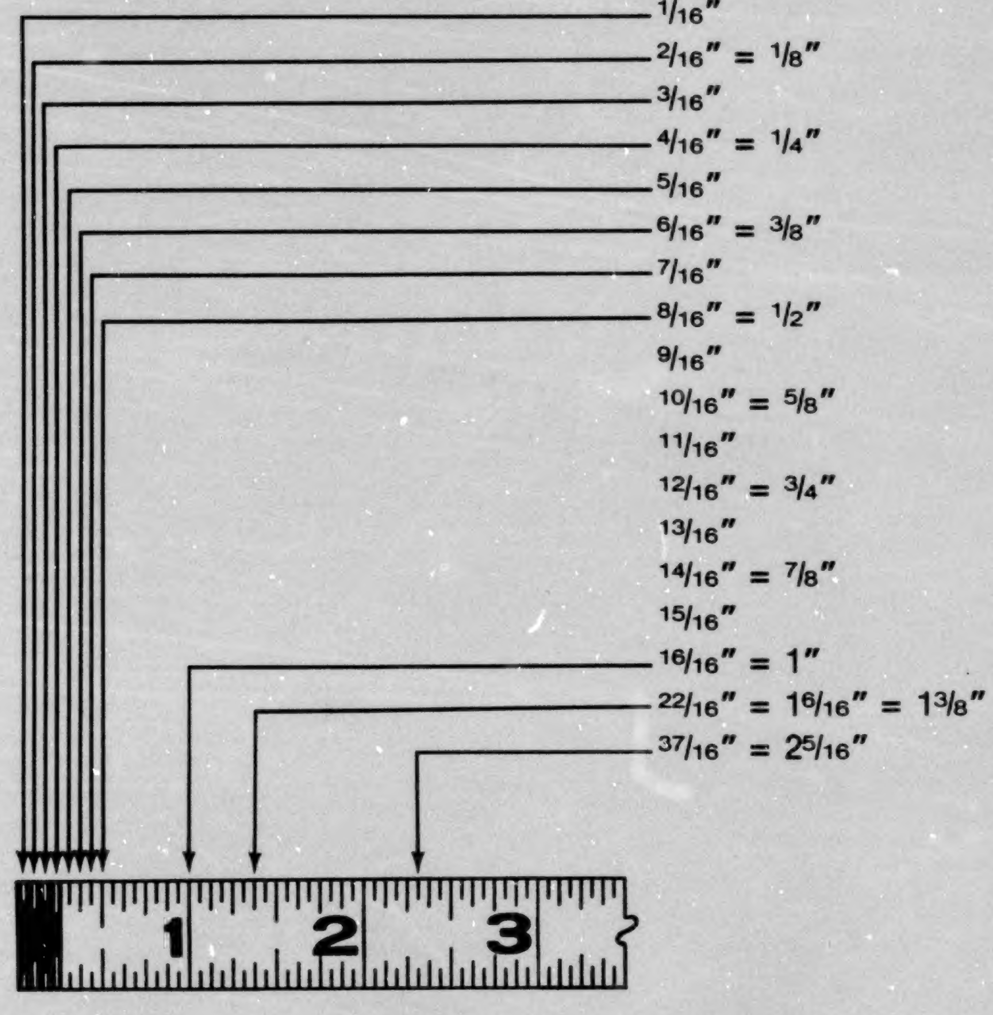
Reading Fourths on a Carpenter's Rule


1/4"
2/4" = 1/2"
3/4"
4/4" = 1"
7/4" = 1 3/4"
1
2
3

Reading Eighths on a Carpenter's Rule


1/8"
2/8" = 1/4"
3/8"
4/8" = 1/2"
5/8"
6/8" = 3/4"
7/8"
8/8" = 1"
13/8" = 15/8"
1
2
3

Reading Sixteenths on a Carpenter's Rule


1/16"
2/16" = 1/8"
3/16"
4/16" = 1/4"
5/16"
6/16" = 3/8"
7/16"
8/16" = 1/2"
9/16"
10/16" = 5/8"
11/16"
12/16" = 3/4"
13/16"
14/16" = 7/8"
15/16"
16/16" = 1"
22/16" = 1 6/16" = 1 3/8"
37/16" = 2 5/16"
1
2
3

MEASURING
UNIT II

INFORMATION SHEET

I. Terms and definitions

A. Measuring — Setting of limits or bounds according to a predetermined standard

(NOTE: The standard used in measuring is called a *unit of measurement* or simply *unit*. Examples of units used to measure distance include inches, feet, meters, and miles.)

B. Rule — Measuring instrument graduated in whole units and fractions of units

(NOTE: The term *rule* is generally applied to any measuring instrument used to determine distances. One special kind of rule is the *tape*, a steel strip marked in graduations. Tapes can be reeled into a container. In carpentry, a rule is usually used for measuring distances of a few feet or less and for marking straight lines. A tape is used for measuring distances from a few inches to a hundred feet or more.)

C. Graduations — Marks on a rule or tape indicating measurements

EXAMPLES: Sixteenths, quarters, halves, inches, and feet; hundredths, tenths, and feet

D. Foot — Unit of measure consisting of twelve equal parts called *inches*

E. Inch — Smallest whole unit of lineal measure commonly used

F. Divisions — Parts or sections on a rule that make up 1 inch

G. Fraction — Part of a whole; represents one or more equal parts of a unit

EXAMPLES: $^1/_2$, $^3/_8$, $^1/_4$, $^3/_{16}$

H. Lineal — Relating to, consisting of, or resembling a straight line

I. Dimensions — Arrangement of lines to indicate the actual size for constructing the object or structure represented

J. Layout — Plan or design of the project to be constructed

K. Perimeter — Outer limits or boundaries

L. Keel — Type of colored marking crayon used in construction

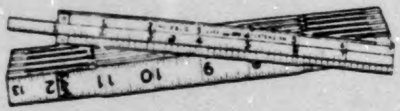
M. Taut — Tightly stretched; not slack

INFORMATION SHEET

II. Basic measuring tools used by carpenters (Figures 1-9)

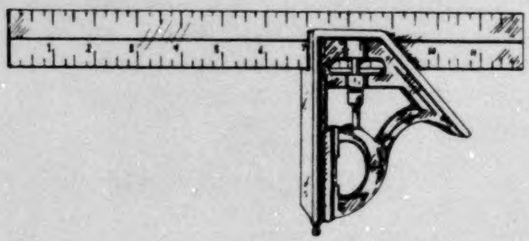
A. Carpenter's folding rule

FIGURE 1



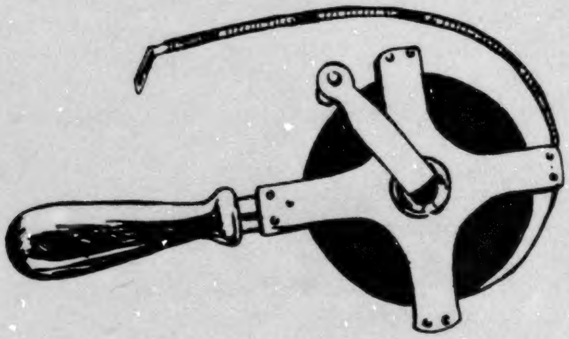
B. Combination square

FIGURE 2



C. Two-hundred-foot steel tape and reel

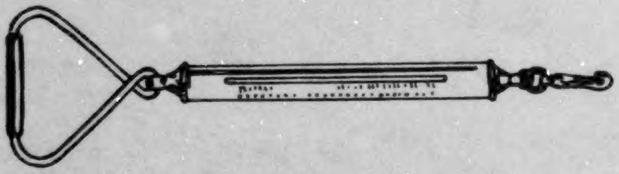
FIGURE 3



INFORMATION SHEET

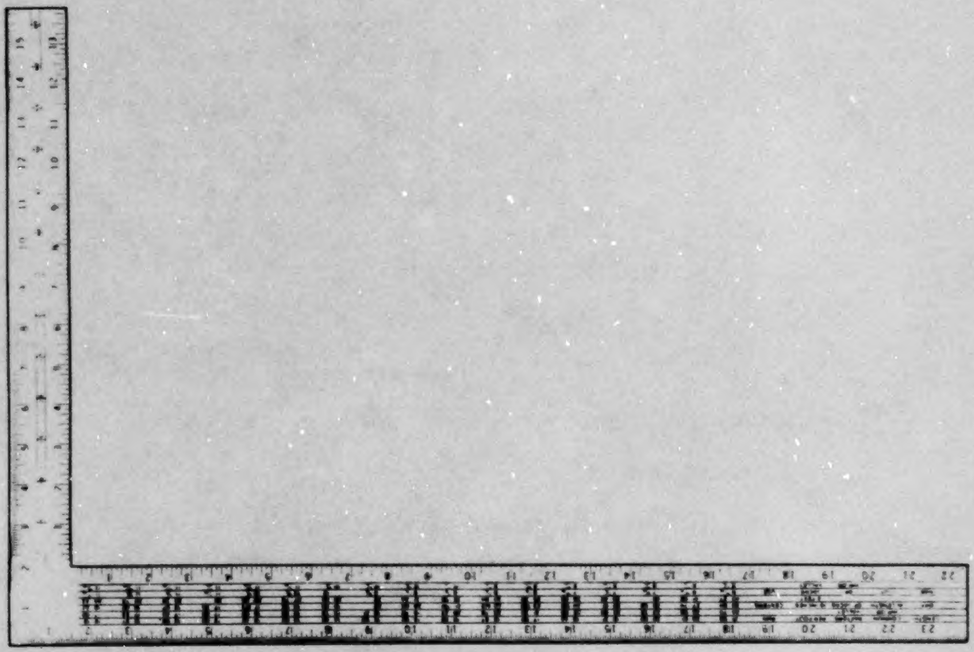
D. Spring-balanced tape tension handle

FIGURE 4



E. Steel framing square

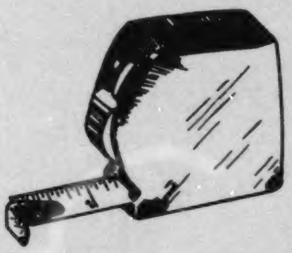
FIGURE 5



INFORMATION SHEET

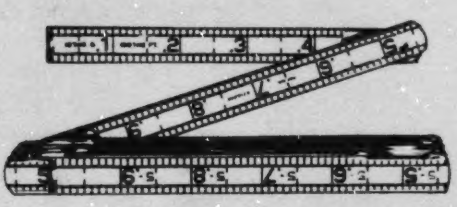
F. Sixteen-foot steel tape

FIGURE 6



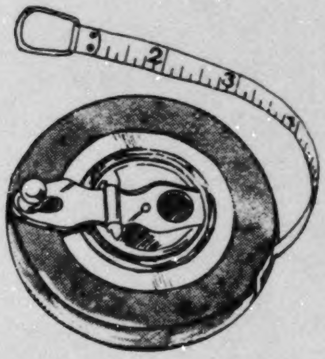
G. Engineer's folding rule

FIGURE 7



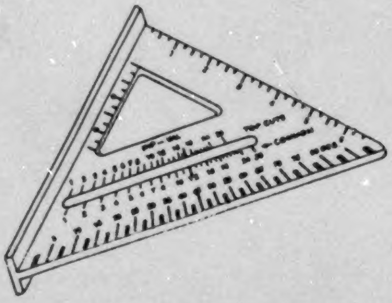
H. One-hundred-foot steel tape

FIGURE 8



I. Speed square

FIGURE 9



Used with permission of the Swanson Tool Company, Oak Lawn, Illinois.

III. Common errors that contribute to incorrect measurements

A. Leaving slack in tape

B. Not laying tape flat (tape is twisted or kinked)

C. Not aligning tape or rule properly

D. Not placing end of tape or rule on reference point

E. Reading incorrect number

F. Recording incorrect number

G. Using wrong reference point

H. Making errors in mathematical computations

EXAMPLE: When converting from one unit of measurement to another

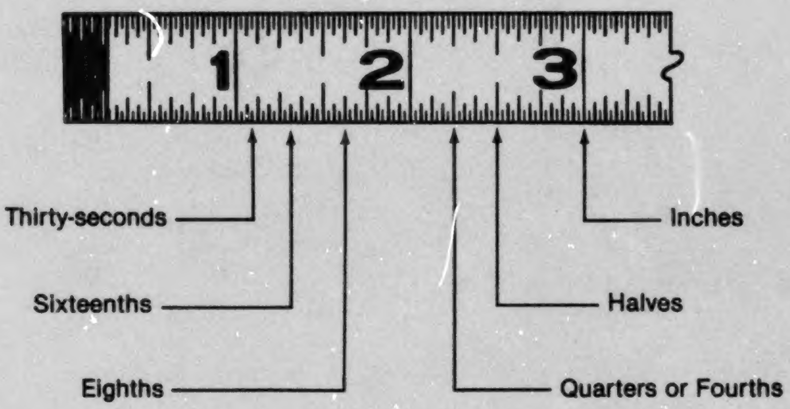
INFORMATION SHEET

I. Using incorrect measuring tool for job being performed

IV. Graduations on a carpenter's rule (Figure 10)

(NOTE: Some rules will not have all of the graduations shown in Figure 10.)

FIGURE 10



(NOTE: Thirty-two 32nds equal 1 inch. Sixteen 16ths equal 1 inch. Eight 8ths equal 1 inch. Four 4ths equal 1 inch. Two halves equal 1 inch. Twelve inches equal 1 foot.)

V. Reading a carpenter's rule to the nearest fraction of an inch

(NOTE: All rules are read similarly. However, rules may have different graduations, and some rules may have special markings for specific purposes. Layout rules, for instance, are marked every 16 inches as an aid in determining stud locations on 16-inch centers.)

A. Align the end of the rule with one reference point

B. Determine the number of whole units between end of rule and second reference point

(NOTE: The unit of measurement will vary, depending on the distance being measured and the use being made of the measurement. Most short measurements are made in inches, even if they are more than 1 foot long. Skilled carpenters are generally able to quickly convert measurements from feet to inches or vice versa for distances of 10 to 12 feet or more. Thus, a carpenter may speak of a sheet of plywood as 4 by 8 feet or as 48 by 96 inches.)

C. Determine the number of fractional units between last whole unit and second reference point

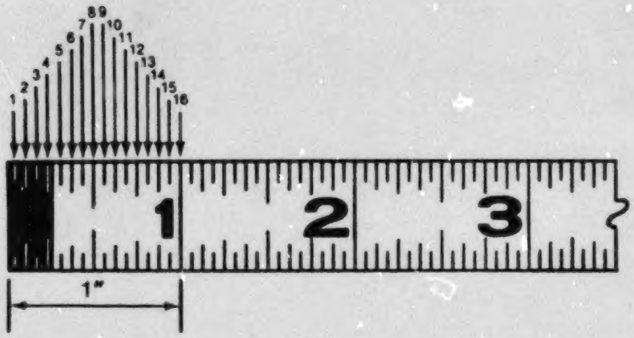
INFORMATION SHEET

1. Determine number of graduations per inch (Figure 11)

   (NOTE: At first you may have to count the number of divisions in an inch. However, with some practice, you will be able to recognize the divisions on sight and will eventually be able to determine fractional units just by looking at the rule.)

   EXAMPLE:

FIGURE 11

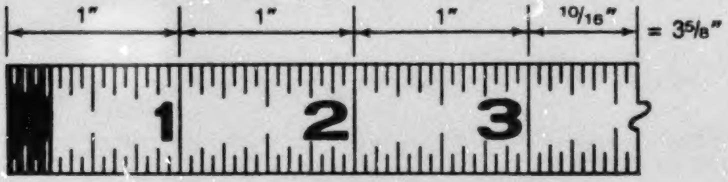


2. Determine the fractional part of an inch by counting the number of divisions between last inch and second reference point

3. Reduce the fraction if possible (Figure 12)

   EXAMPLE:

FIGURE 12



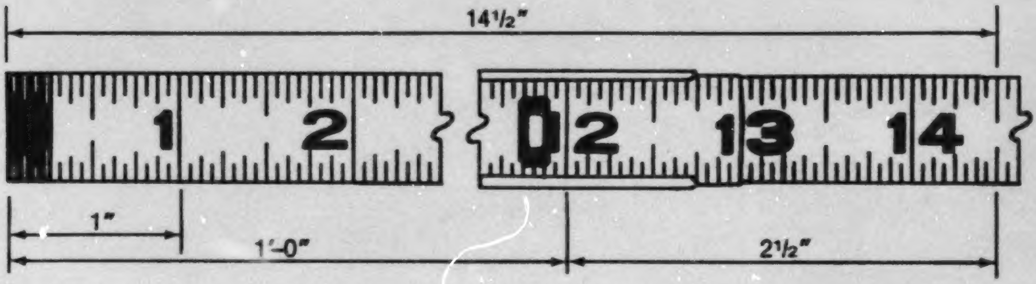
(NOTE: In the example above, the rule is divided into sixteenths. There are ten divisions between the last inch mark—3 inches—and the reference point. The 10/16 can be reduced to 5/8.)

INFORMATION SHEET

D. Determine the reading by adding fractional units to whole units and converting inches to feet or feet to inches if necessary (Figure 13)

EXAMPLE: The rule below shows a measurement of 1′ – 2½″ or 14½″.

FIGURE 13



VI. Converting fractional inches to hundredths of a foot

(NOTE: There are two general methods used by the industry today for converting fractional inches to hundredths of a foot. One method is to apply the formula and rules described in this section. The formula is not exact, but it is generally accurate enough for the requirements of the carpentry trade and for use with the rules that a carpenter may have. The second method is to refer to a conversion table. See Table 1.)

A. Apply the following guidelines in the conversion process

1. Consider each 12 inches to be equal to 1.00 foot.
2. Consider each ⅛ inch to be equal to 0.01 foot
3. To allow for the difference between ⅛ inch and 0.01 foot, add another 0.01 foot for 2 inches, 0.02 foot for 5 inches, 0.03 foot for 8 inches, and 0.04 foot for 11 inches

B. Use the following steps in the conversion process

1. Write the number of whole feet as a whole number to the left of the decimal point
2. Convert the remaining inches and fractional parts of inches to hundredths of a foot
   a. Change the inches and fractions to eighths, rounding sixteenths and thirty-seconds to the nearest eighth as necessary

INFORMATION SHEET

b. Multiply the numerator by 0.01

c. Add the product of the two numbers to the whole-foot number determined in guideline A3

3. Add the required number for quantities of 2 inches or more as described in step A3

EXAMPLE 1: Convert $14' - 5\frac{1}{4}''$ to hundredths of an inch.

a. $14' = 14.00'$

b. $5\frac{1}{4}'' = \frac{21}{4}'' = \frac{42}{8}''$

c. $42 \times 0.01 = .42$

d. Add 0.02 for 5 inches

e.
$$\begin{array}{r} 14.00 \\ 0.42 \\ +\ 0.02 \\ \hline 14.44' \end{array}$$

EXAMPLE 2: Convert $5' - \frac{3}{16}''$ to hundredths of a foot.

a. $5' = 5.00'$

b. $\frac{3}{16}'' = \frac{1.5}{8}''$

c. $\frac{1.5}{8}''$ rounds to $\frac{2}{8}''$

d. $2 \times 0.01 = .02$

e.
$$\begin{array}{r} 5.00 \\ +0.02 \\ \hline 5.02' \end{array}$$

INFORMATION SHEET

EXAMPLE:

TABLE 1

Standard hundredths conversion

1/8" = .01
1/4" = .02
3/8" = .03
1/2" = .04
5/8" = .05
3/4" = .06
7/8" = .07

1" = .08
1 1/8" = .09
1 1/4" = .10
1 3/8" = .11
1 1/2" = .12
1 5/8" = .13
1 3/4" = .14
1 7/8" = .15

2" = .16 + .01 = .17
2 1/8" = .18
2 1/4" = .19
2 3/8" = .20
2 1/2" = .21
2 5/8" = .22
2 3/4" = .23
2 7/8" = .24
3" = .25

3 1/8" = .26
3 1/4" = .27
3 3/8" = .28
3 1/2" = .29
3 5/8" = .30
3 3/4" = .31
3 7/8" = .32

4" = .33
4 1/8" = .34
4 1/4" = .35
4 3/8" = .36
4 1/2" = .37
4 5/8" = .38
4 3/4" = .39
4 7/8" = .40

5" = .41 + .01 = .42
5 1/8" = .43
5 1/4" = .44
5 3/8" = .45
5 1/2" = .46
5 5/8" = .47
5 3/4" = .48
5 7/8" = .49
6" = .50

6 1/8" = .51
6 1/4" = .52
6 3/8" = .53
6 1/2" = .54
6 5/8" = .55
6 3/4" = .56
6 7/8" = .57

7" = .58
7 1/8" = .59
7 1/4" = .60
7 3/8" = .61
7 1/2" = .62
7 1/2" = .63
7 3/4" = .64
7 7/8" = .65

8" = .66 + .01 = .67
8 1/8" = .68
8 1/4" = .69
8 3/8" = .70
8 1/2" = .71
8 5/8" = .72
8 3/4" = .73
8 7/8" = .74
9" = .75

9 1/8" = .76
9 1/4" = .77
9 3/8" = .78
9 1/2" = .79
9 5/8" = .80
9 3/4" = .81
9 7/8" = .82

10" = .83
10 1/8" = .84
10 1/4" = .85
10 3/8" = .86
10 1/2" = .87
10 1/2" = .88
10 3/4" = .89
10 7/8" = .90

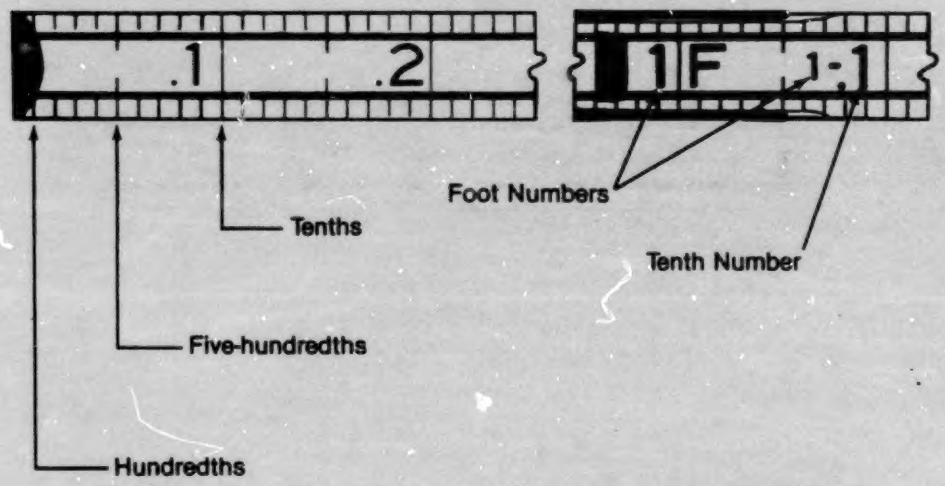
11" = .91 + .01 = .92
11 1/8" = .93
11 1/4" = .94
11 3/8" = .95
11 1/2" = .96
11 5/8" = .97
11 3/4" = .98
11 7/8" = .99
12" = 1.00

INFORMATION SHEET

VII. Graduations on an engineer's rule (Figure 14)

(NOTE: Many engineer's rules contain running foot indicators.)

FIGURE 14



(NOTE: Ten 100ths equal 1/10 of a foot. Two 5/100ths equal 1/10 of a foot. Ten 10ths equal 1 foot. Notice that the other graduations on the engineer's rule are also commonly referred to. For example, twenty-five hundredths [0.25] is the same as 1/4 foot or 3 inches, and fifty hundredths [0.050] is the same as 1/2 foot or 6 inches.)

VIII. Reading an engineer's rule to the nearest hundredth of a foot

A. Align end of the rule with one reference point

B. Determine the number of whole units between end of rule and second reference point

(NOTE: The units may be feet or tenths of a foot, depending on the distance measured and the use to be made of the measurement.)

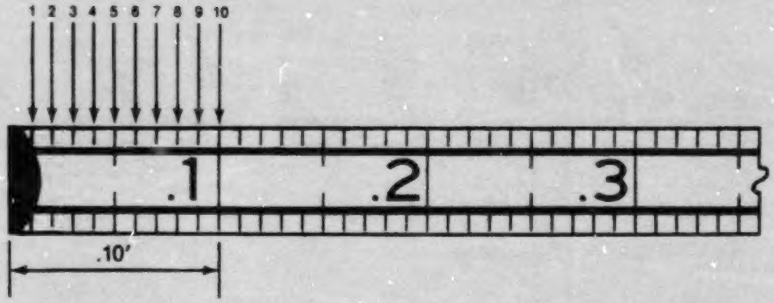
C. Determine the number of decimal units between last whole unit and second reference point

1. Determine the number of graduations per unit (See Figure 15)

INFORMATION SHEET

EXAMPLE: A rule marked off in tenths of a foot may have graduations for each tenth of a tenth or each hundredth of a foot.

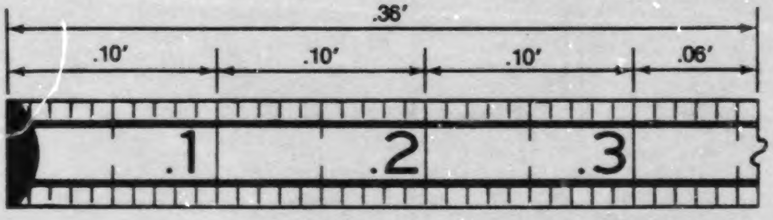
FIGURE 15



2. Count the number of hundredths between last full tenth and second reference point (Figure 16)

EXAMPLE: The rule below shows a measurement of 36 hundredths of a foot, or 0.36'.

FIGURE 16

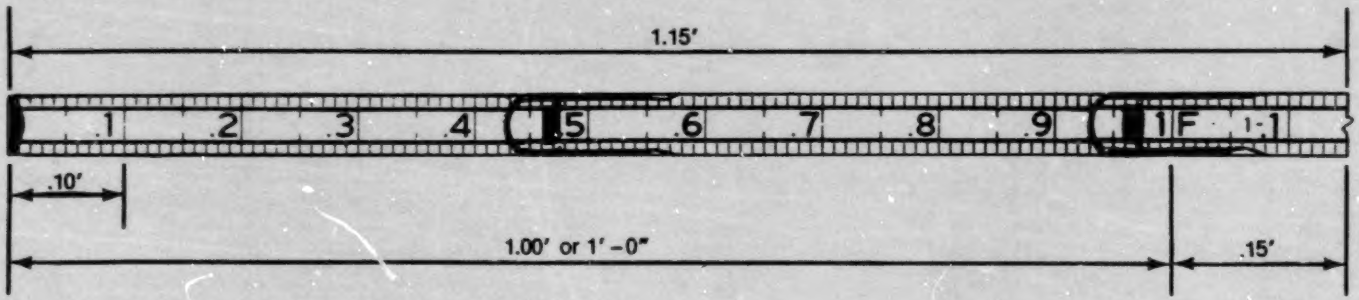


D. Determine the reading by adding decimal units to whole units and converting to feet and decimal parts of a foot if desired (See Figures 17 and 18)

INFORMATION SHEET

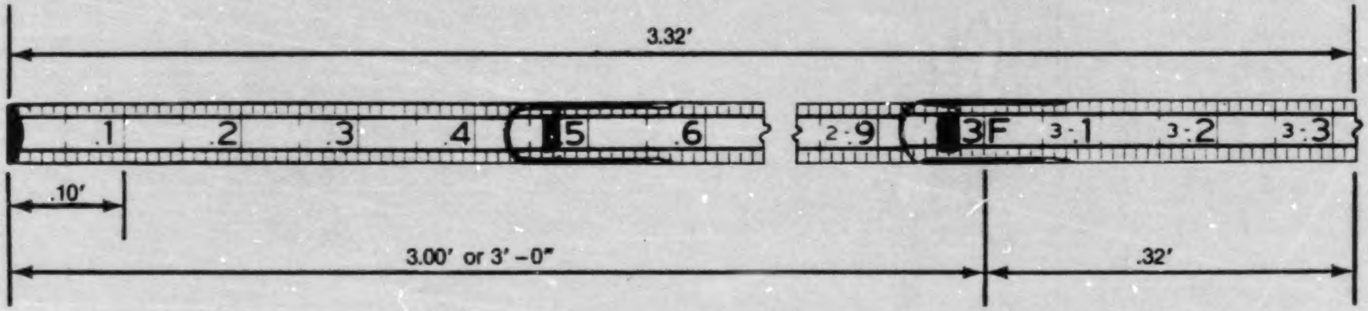
EXAMPLE 1: The rule below shows a measurement of 115 hundredths of a foot, or 1.15'.

FIGURE 17


1.15'
.1
.2
.3
.4
.5
.6
.7
.8
.9
1F
1·1
.10'
1.00' or 1'-0"
.15'

EXAMPLE 2: The rule below shows a measurement of 332 hundredths of a foot, or 3.32'.

FIGURE 18

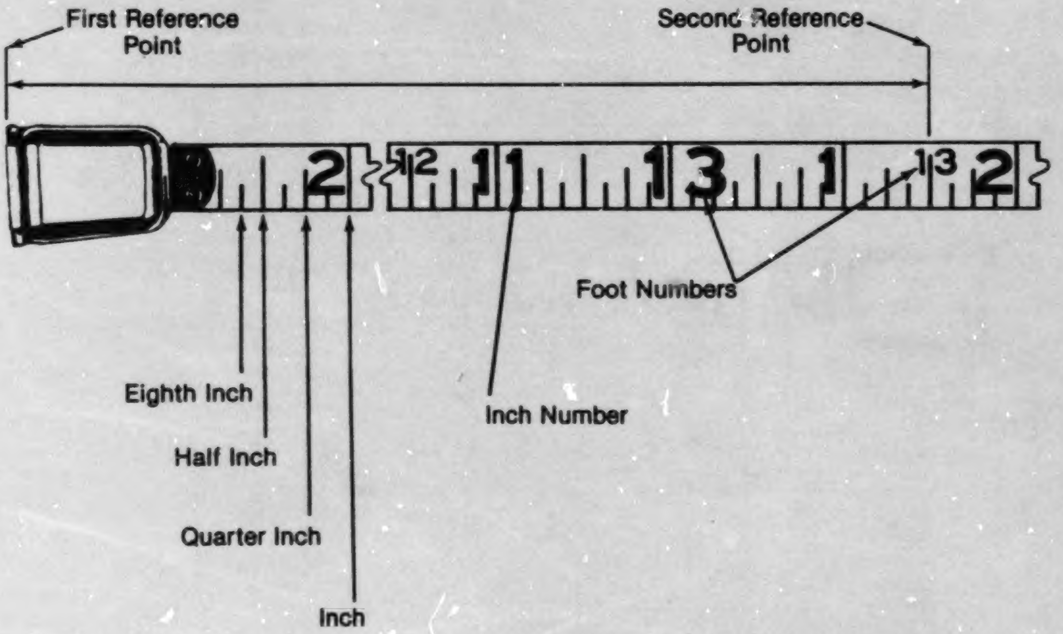

3.32'
.1
.2
.3
.4
.5
.6
2·9
3F
3·1
3·2
3·3
.10'
3.00' or 3'-0"
.32'

INFORMATION SHEET

IX. Graduations on a tape (Figure 19)

(NOTE: The graduations on tapes are the same as the various graduations on rules, but because tapes are used to measure long distances, most tapes contain running foot indicators.)

FIGURE 19


First Reference Point
Second Reference Point
Foot Numbers
Eighth Inch
Half Inch
Quarter Inch
Inch
Inch Number

(NOTE: The tape in Figure 19 reads thirteen feet and one and one-half inches [13′ – 1½″] at the second reference point.)

X. Reading a tape to the nearest fraction of an inch

A. Place end of tape on one reference point

B. Reading from starting end of tape, determine number of feet to second reference point

C. Determine number of inches between last whole-foot mark and second reference point

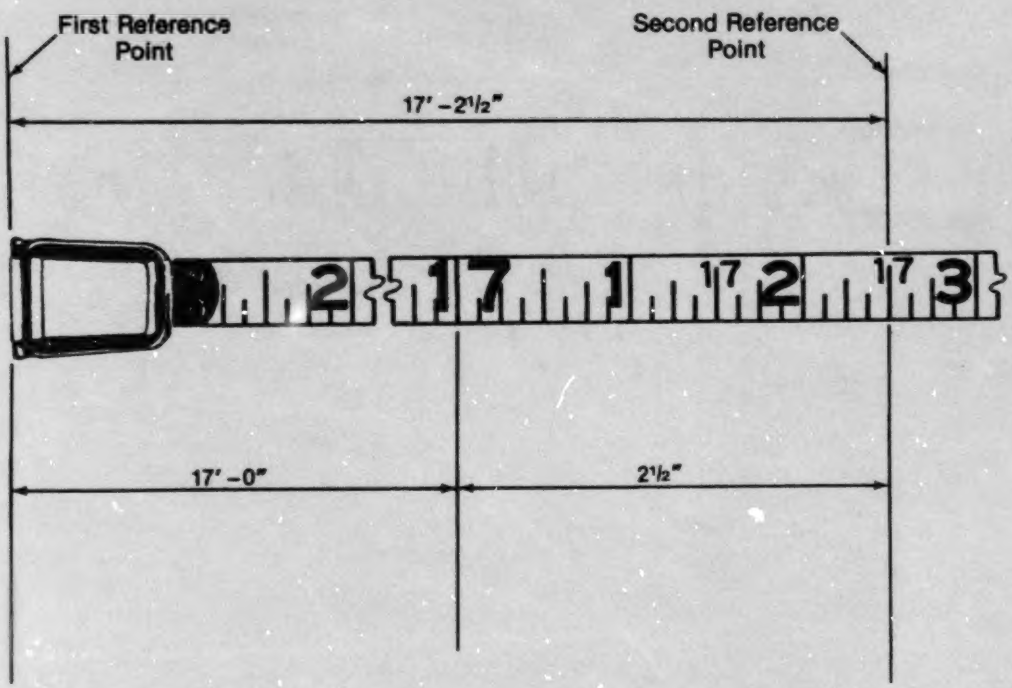
D. Determine fractional inches between last whole-inch mark and second reference point

INFORMATION SHEET

E. Add feet, inches, and fraction of an inch to obtain correct measurement (Figure 20)

EXAMPLE: The tape below reads seventeen feet two and one-half inches (17′ –2½″) at the second reference point.

FIGURE 20


First Reference Point
Second Reference Point
17′ –2½″
2
17
1
17 2
17 3
17′ –0″
2½″

XI. Measuring methods used to square lines

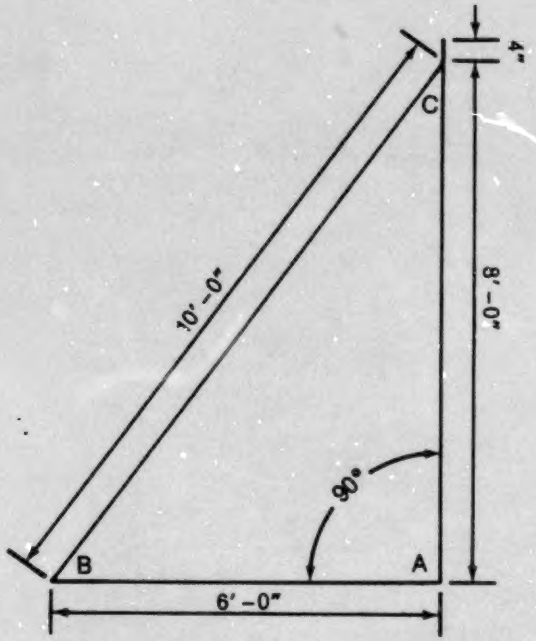
A. 3-4-5 method — Forming a right triangle using largest multiple of 3-4-5 feet (6-8-10, 12-16-20, 24-32-40, etc.) possible for length of lines being squared, and ensuring that longest side of triangle is exact appropriate multiple of 5 (See Figure 21)

INFORMATION SHEET

EXAMPLE: Use the 3-4-5 method to square building lines 6′ – 0″ and 8′ – 4″.

(NOTE: The largest multiple that can be used is 6-8-10.)

FIGURE 21



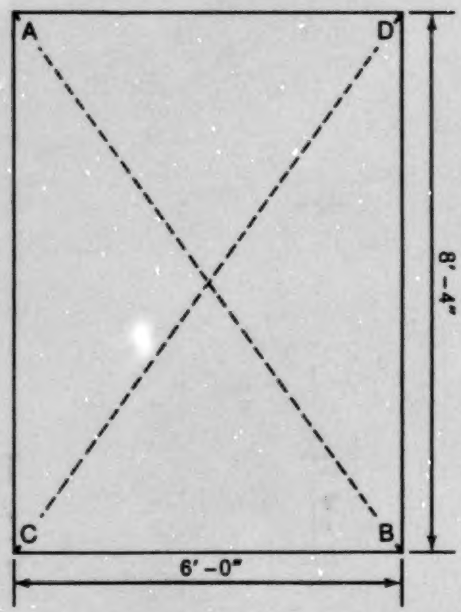
1. Measure 6 feet from point A to point B; mark
2. Measure 8 feet from point A to point C; mark
3. Measure from point B to point C
4. If the lines are square, measurement from point B to point C will be exactly 10 feet; if the measurement is not exactly 10 feet, adjust one of the lines

B. Diagonal method — Measuring diagonally from inside corners of layout and ensuring that diagonal lines are equal in length (See Figure 22)

INFORMATION SHEET

EXAMPLE: Use the diagonal method to square building lines 6′ -0″ and 8′ -4″.

FIGURE 22



1. Measure diagonally from point A to point B
2. Record this measurement
3. Measure diagonally from point C to point D
4. Record this measurement
5. If building lines are square, both diagonal measurements (AB and CD) will be exactly the same; if they are not exactly the same, adjust one of the lines

MEASURING
UNIT II

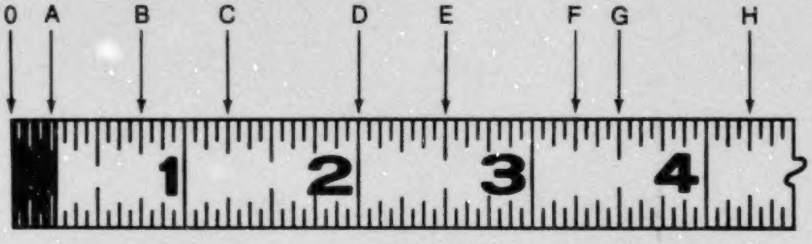
ASSIGNMENT SHEET #1 — READ MEASUREMENTS ON CARPENTER'S AND ENGINEER'S RULES

NAME ______________________________ SCORE ______________

The first step in being able to make accurate measurements is to become familiar with the graduations on rules and how to read them. This assignment sheet will allow you to practice reading measurements on rules.

PART I

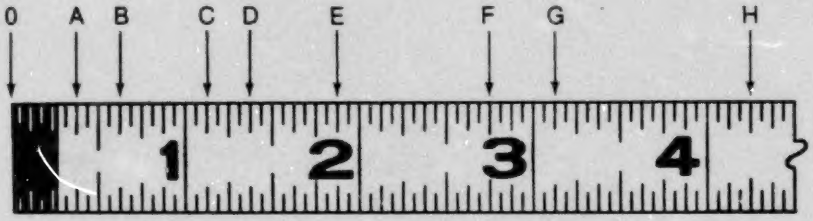
A. Read the carpenter's rule illustrated below to the nearest quarter inch. Write your answers on the lines provided.



1. 0 to A = ____________________
2. A to B = ____________________
3. 0 to C = ____________________
4. A to D = ____________________
5. B to D = ____________________
6. 0 to E = ____________________
7. C to E = ____________________
8. B to F = ____________________
9. D to G = ____________________
10. A to H = ____________________

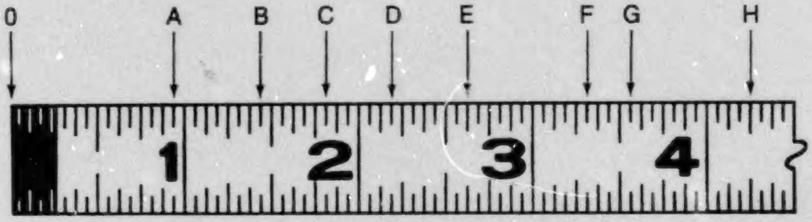
ASSIGNMENT SHEET #1

B. Read the carpenter's rule illustrated below to the nearest eighth inch. Write your answers on the lines provided.



1. 0 to A = ______________________
2. A to B = ______________________
3. 0 to C = ______________________
4. B to D = ______________________
5. A to E = ______________________
6. 0 to F = ______________________
7. D to F = ______________________
8. C to G = ______________________
9. A to H = ______________________
10. E to H = ______________________

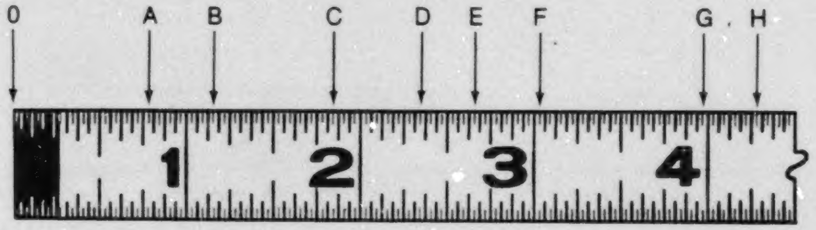
C. Read the carpenter's rule illustrated below to the nearest sixteenth inch. Write your answers on the lines provided.



1. 0 to A = ______________________
2. A to B = ______________________
3. 0 to C = ______________________
4. B to D = ______________________
5. A to E = ______________________
6. 0 to F = ______________________
7. C to F = ______________________
8. A to G = ______________________
9. 0 to H = ______________________
10. E to H = ______________________

ASSIGNMENT SHEET #1

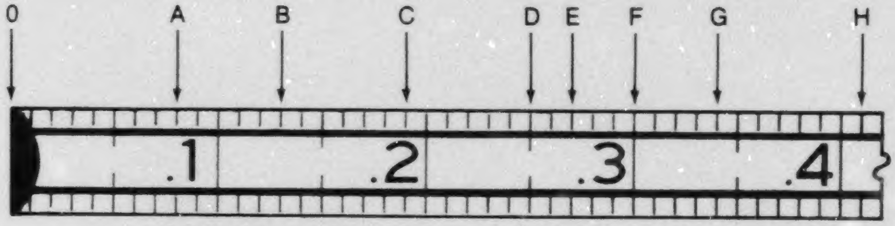
D. Read the carpenter's rule illustrated below to the nearest one-thirty-seconds inch. Write your answers on the lines provided.



1. 0 to A = ____________________
2. 0 to B = ____________________
3. A to B = ____________________
4. 0 to C = ____________________
5. A to D = ____________________
6. B to E = ____________________
7. C to F = ____________________
8. B to G = ____________________
9. 0 to H = ____________________
10. D to H = ____________________

PART II

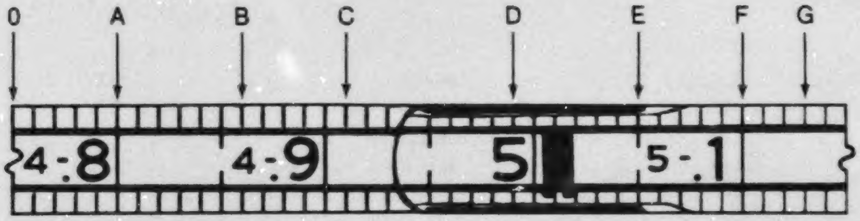
A. Read the engineer's rule illustrated below to the nearest hundredth of a foot. Write your answers on the lines provided.



1. 0 to A = ____________________
2. A to B = ____________________
3. 0 to C = ____________________
4. B to E = ____________________
5. 0 to D = ____________________
6. C to F = ____________________
7. D to G = ____________________
8. 0 to F = ____________________
9. E to H = ____________________
10. 0 to H = ____________________

ASSIGNMENT SHEET #1

B. Read the engineer's rule illustrated below to the nearest hundredth of a foot. Write your answers on the lines provided.



1. A = ____________________

2. B = ____________________

3. C = ____________________

4. D = ____________________

5. E = ____________________

6. F = ____________________

7. G = ____________________

8. A to D = ____________________

9. B to F = ____________________

10. C to G = ____________________

MEASURING
UNIT II

ASSIGNMENT SHEET #2 — MEASURE OBJECTS

NAME ______________________________ SCORE ______________

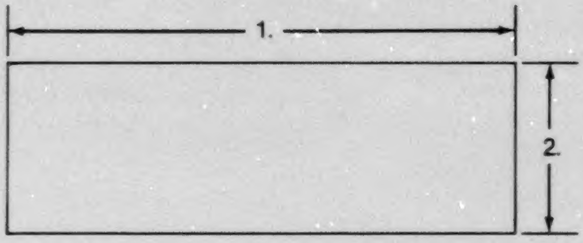
To build a structure accurately, the carpenter must be able to correctly measure boards, openings for doors and windows, cuts to fit plywood and drywall, and all the other parts that must be the right size and shape for proper building construction. A carpenter will use measuring skills in every phase of construction; thus, it is essential for the carpenter to master the ability to measure.

PART I

Measure the following objects, using a rule graduated in sixteenths of an inch.

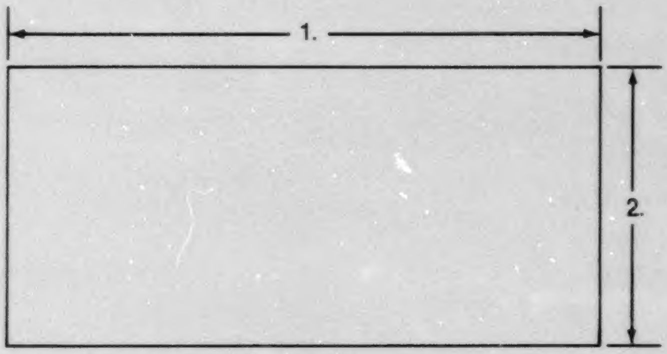
A. 1. Length = ______________

2. Height = ______________



B. 1. Length = ______________

2. Height = ______________

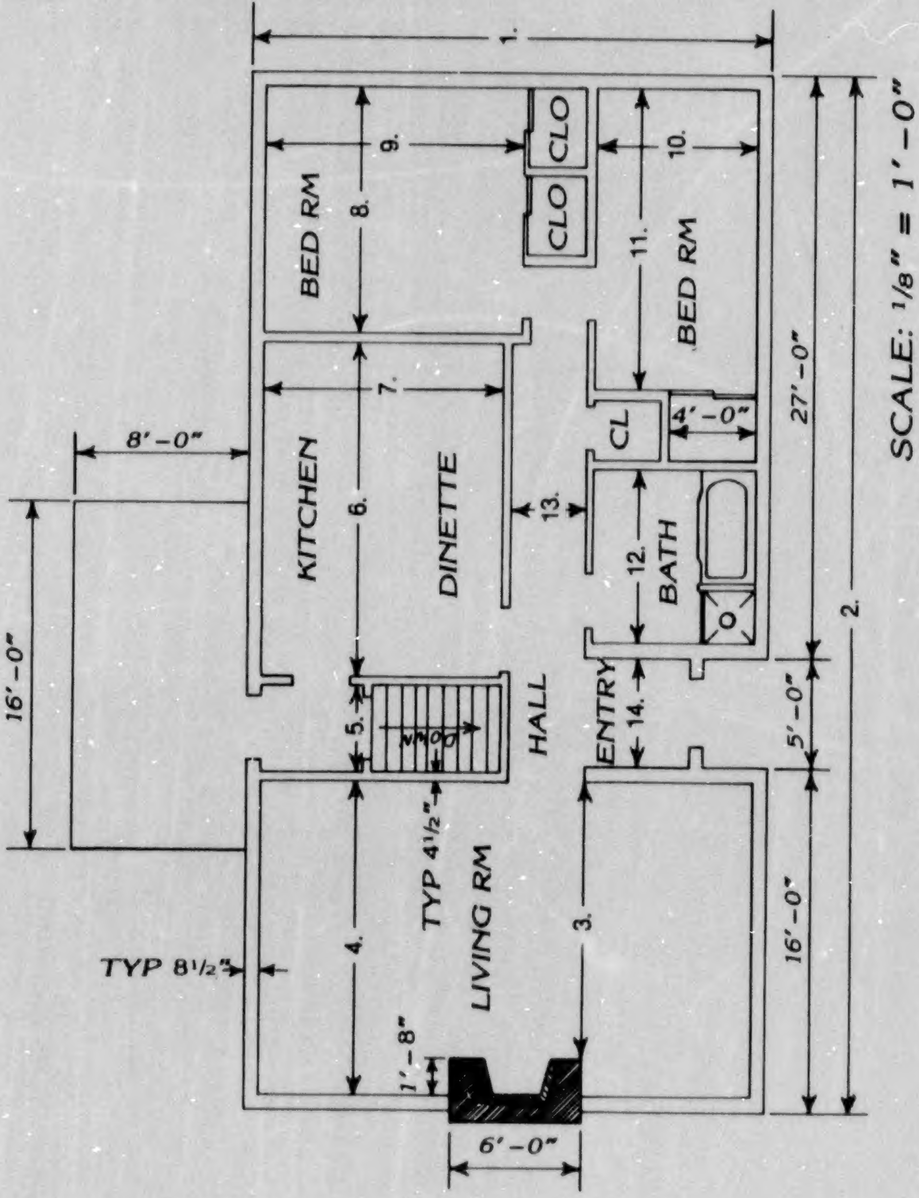


ASSIGNMENT SHEET #2

PART II

Because of the size of projects with which carpenters work, it is usually necessary to make *scale drawings* of houses, buildings, cabinets, etc. A scale drawing uses one dimension to represent another, and all dimensions on the drawing are reduced in the same proportion. For example, using a scale in which 1 inch on the drawing is equal to 1 foot on the actual object 4 feet high and 5 feet long, the drawing would be 4 inches by 5 inches.

A. Using a scale of 1/8 inch equals 1 foot, determine the dimensions represented on this plan. Write your answers in the blanks provided on the next page. Dimensions may be slightly distorted due to printing.


1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
BED RM
CLO
CLO
BED RM
KITCHEN
DINETTE
CL
4'-0"
BATH
HALL
ENTRY
DOWN
LIVING RM
TYP 4½"
TYP 8½"
1'-8"
6'-0"
8'-0"
16'-0"
27'-0"
5'-0"
16'-0"
SCALE: 1/8" = 1'-0"

ASSIGNMENT SHEET #2

1. =______________________________

2. =______________________________

3. =______________________________

4. =______________________________

5. =______________________________

6. =______________________________

7. =______________________________

8. =______________________________

9. =______________________________

10. =______________________________

11. =______________________________

12. =______________________________

13. =______________________________

14. =______________________________

B. Your instructor will indicate objects and structures in your shop area for you to measure. Measure the objects and write down the dimensions. Beside the dimensions, write the length that a line for that dimension would be on a drawing with a scale of ¼ inch equals 1 foot.

MEASURING
UNIT II

ASSIGNMENT SHEET #3 — CONVERT FRACTIONAL INCHES TO HUNDREDTHS OF A FOOT

NAME ______________________________ SCORE ______________

Many rules are marked in hundredths of a foot. Often the carpenter is required to convert inch dimensions to decimal fractions of a foot. This exercise will help you become more proficient at converting fractional inches to hundredths of a foot.

Using the three guidelines below, convert the following inch dimensions to hundredths of a foot. Show your work.

- Consider each 12 inches to be equal to 1.00 foot
- Consider each $^1/_8$ inch to be equal to 0.01 foot
- Add 0.01 foot for 2 inches, 0.02 foot for 5 inches, 0.03 foot for 8 inches, and 0.04 foot for 11 inches

EXAMPLE: Convert 6′ – 4$^1/_8$″ to hundredths of a foot.

a. 6′ = 6.00

b. 4$^1/_8$″ = $^{33}/_8$ = 0.33

c. Add 0.01

d.
$$\begin{array}{r}6.00\\0.33\\+0.01\\\hline 6.34'\end{array}$$

A. $^1/_4$″ = ______________________

B. 14′ – 5$^1/_2$″ = ______________________

C. $^3/_4$″ = ______________________

D. 6$^5/_8$″ = ______________________

ASSIGNMENT SHEET #3

E. $1^3/_8$" = ______________________ F. 7' − $7^1/_8$" = ______________________

G. $2^7/_8$" = ______________________ H. 2' − 8" = ______________________

I. 4" = ______________________ J. $11^3/_8$" = ______________________

MEASURING
UNIT II

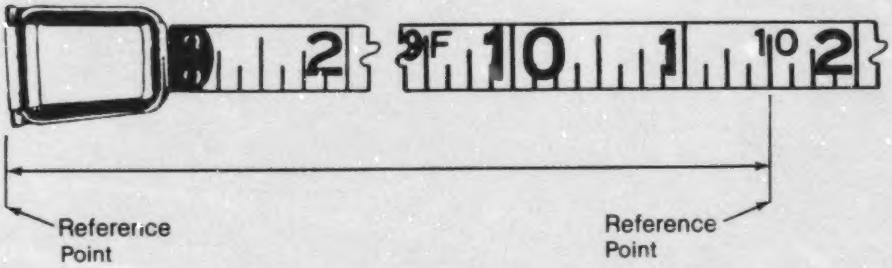
ASSIGNMENT SHEET #4 — READ MEASUREMENTS ON TAPES

NAME ______________________________ SCORE ______________

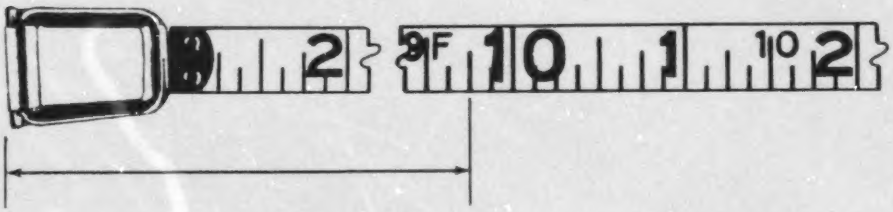
This exercise will help you to develop a better knowledge of reading a tape and will help you to read a tape quickly and efficiently.

Using the procedures outlined in Section X of the Information Sheet, read the following tapes and write the correct dimensions on the lines between the reference points.

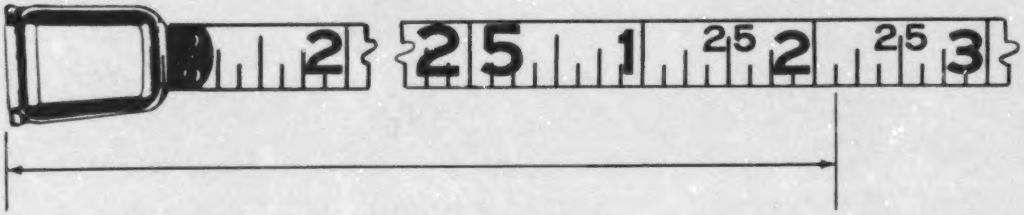
A.


2
9F
10
1
10
2
Reference Point
Reference Point

B.

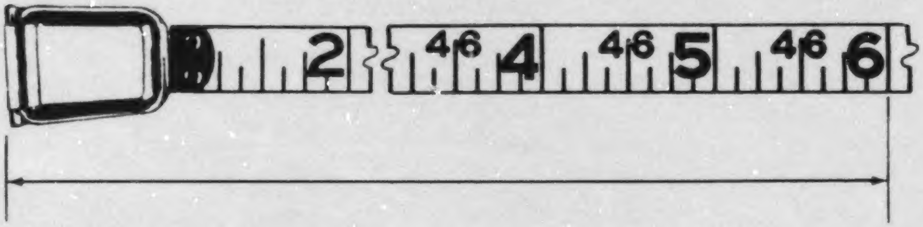


C.

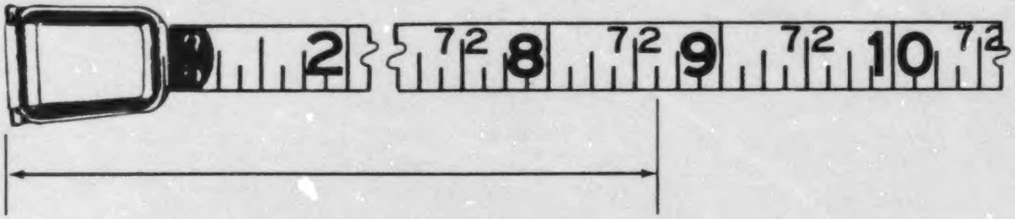

2
25
1
25
2
25
3

ASSIGNMENT SHEET #4

D.


2
46
4
46
5
46
6

E.


2
72
8
72
9
72
10
72

MEASURING
UNIT II

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

Part I

A. 1. 1/4"
2. 1/2"
3. 1 1/4"
4. 1 3/4"
5. 1 1/4"
6. 2 1/2"
7. 1 1/4"
8. 2 1/2"
9. 1 1/2"
10. 4"

B. 1. 3/8"
2. 1/4"
3. 1 1/8"
4. 3/4"
5. 1 1/2"
6. 2 3/4"
7. 1 3/8"
8. 2"
9. 3 7/8"
10. 2 3/8"

C. 1. 15/16"
2. 1/2"
3. 1 13/16"
4. 3/4"
5. 1 11/16"
6. 3 5/16"
7. 1 1/2"
8. 2 5/8"
9. 4 1/4"
10. 1 5/8"

D. 1. 25/32"
2. 1 5/32"
3. 3/8"
4. 1 27/32"
5. 1 9/16"
6. 1 1/2"
7. 1 3/16"
8. 2 13/16"
9. 4 9/32"
10. 1 15/16"

Part II

A. 1. 0.08′
2. 0.05′
3. 0.19′
4. 0.14′
5. 0.25′
6. 0.11′
7. 0.09′
8. 0.30′
9. 0.14′
10. 0.41′

B. 1. 4.80′
2. 4.86′
3. 4.91′
4. 4.99′
5. 5.05′
6. 5.10′
7. 5.13′
8. 0.19′
9. 0.24′
10. 0.22′

Assignment Sheet #2

Part I

A. 1. 2 15/16"
2. 1"

B. 1. 3 7/16"
2. 1 5/8"

Part II

A. 1. 24′-0"
2. 48′-0"
3. 12′-10"
4. 14′-6"
5. 4′-0"
6. 15′-6"
7. 11′-0"
8. 11′-6"
9. 12′-0"
10. 7′-6"
11. 14′-0"
12. 8′-0"
13. 3′-6"
14. 5′-0"

B. Evaluated to the satisfaction of the instructor

Assignment Sheet #3

A. 0.02′
B. 14.46′
C. 0.06′
D. 0.55′
E. 0.11′
F. 7.59′
G. 0.24′
H. 2.67′
I. 0.33′
J. 0.95′

Assignment Sheet #4

A. 10′-1 1/2"
B. 9′-11 3/4"
C. 25′-2 1/8"
D. 46′-6"
E. 72′-8 5/8"

MEASURING
UNIT II

JOB SHEET #1 — USE BASIC MEASURING TOOLS AND THE 3-4-5 METHOD TO LAY OUT THE PERIMETER OF A BUILDING ON A CONCRETE SLAB

I. Equipment and materials

A. Floor plan at end of job sheet (See Figure 28)

B. Two 50-foot or 100-foot tapes

C. Chalk line

D. Pencil

E. Keel

II. Procedure

(NOTE: Reference point A on concrete slab will be designated by the instructor.)

A. Establish point for south wall (point B, Figure 23)

1. Have an assistant hold one end of a tape exactly on point A (southwest corner of the building)

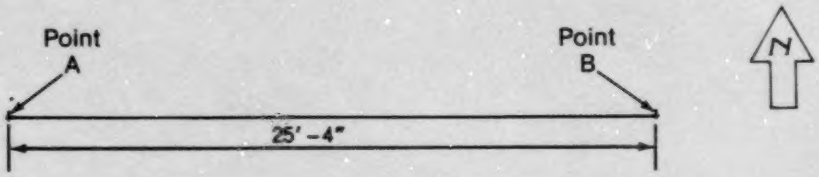
2. From point A, stretch tape for south wall to approximately 26 feet; mark on concrete at exactly 25 feet 4 inches (point B)

   (NOTE: Use keel to circle this and all marks so that they will be easy to identify.)

3. Snap a line from point A to point B with chalk line

   (NOTE: Be sure to keep the chalk line taut so that the line will be straight.)

FIGURE 23

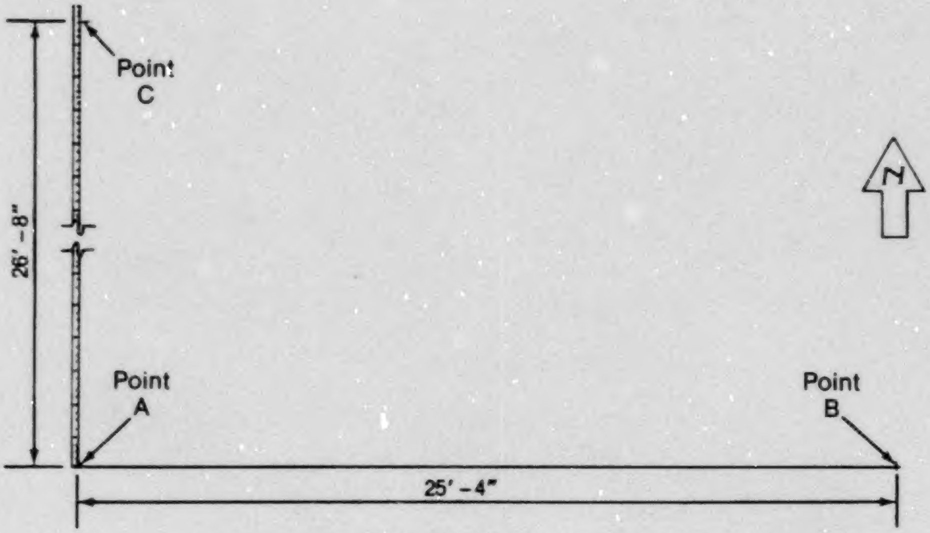


JOB SHEET #1

B. Establish point for west wall (point C, Figure 24)

1. Have an assistant hold end of a tape exactly on point A
2. Stretch tape for west wall to approximately 27 feet; mark on concrete at exactly 26 feet 8 inches (point C)

FIGURE 24



C. Before snapping chalk line for the west wall (line A-C), use the 3-4-5 method to ensure that the line for this wall will be perpendicular to line A-B (See Figure 25)

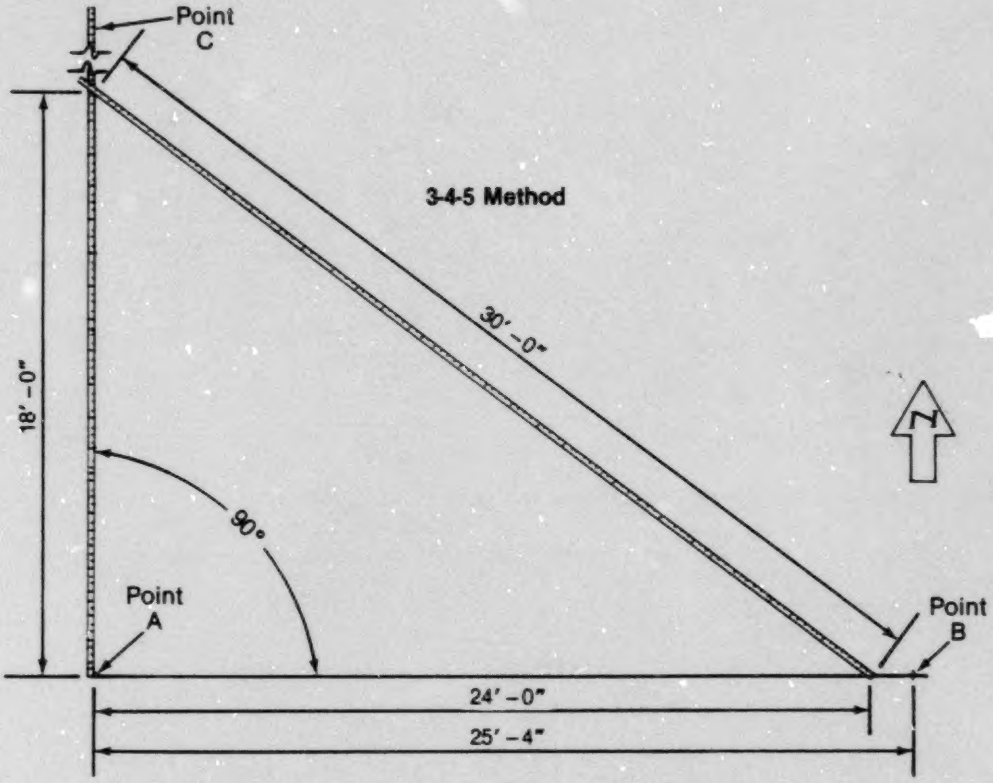
(NOTE: In this particular project, the multiples of 18-24-30 are used.)

1. Starting at point A, measure to exactly 24 feet on line A-B; mark this point on the concrete
2. Have an assistant place end of one tape exactly on point A; keeping tape at a right angle to line AB, stretch tape to 18 feet
3. Have another assistant place end of a second tape exactly on the 24-foot mark on line AB; pull second tape, at an angle, from the 24-foot mark on line AB to the 18-foot graduation on the first tape

JOB SHEET #1

4. Adjust the two tapes until the 30-foot graduation on the second tape croses the 18-foot graduation on the first tape; mark this point on the concrete and remove both tapes

FIGURE 25



D. Snap a line from point A to point C with chalk line, making sure that line passes directly through point where 18-foot and 30-foot measurements crossed

E. Establish point for east and north walls (point D) (See Figure 26)

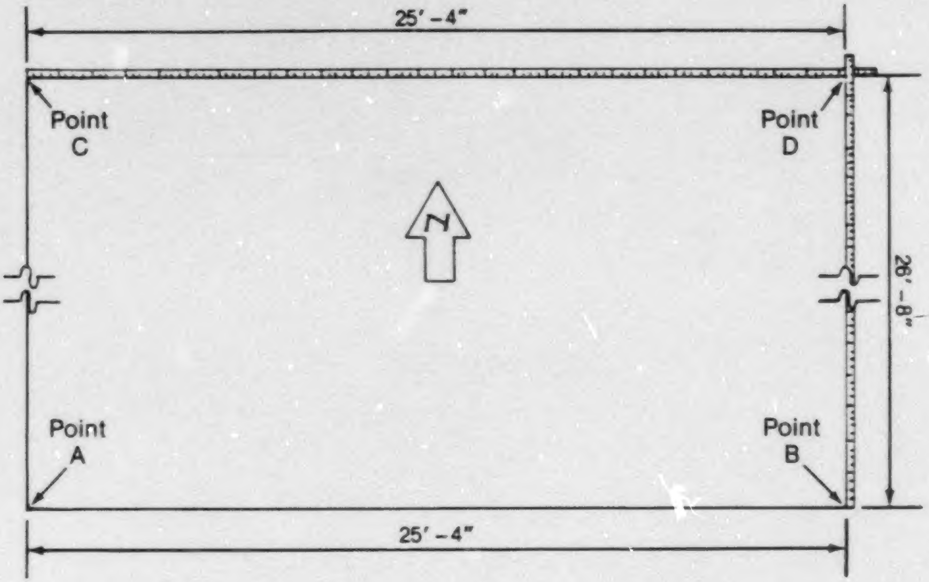
1. Have an assistant place end of one tape exactly on point B; stretch tape for east wall to 26 feet 8 inches (point D)

2. Have another assistant place end of a second tape exactly on point C; stretch tape for north wall to 25 feet 4 inches (point D)

3. Adjust tapes until 26-foot 8-inch graduation on the first tape crosses the 25-foot 4-inch graduation on the second tape; mark this point (point D) on the concrete and remove both tapes

JOB SHEET #1

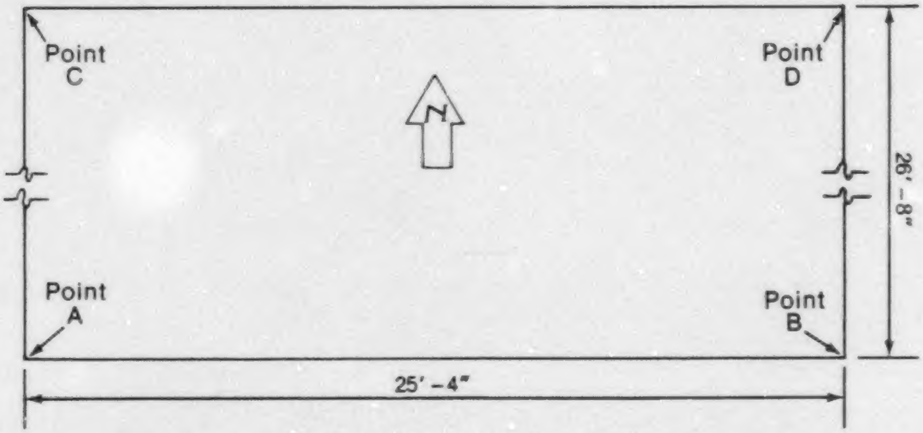
FIGURE 26


25' – 4"
Point C
Point D
N
26' – 8"
Point A
Point B
25' – 4"

F. Snap lines from points C to D and B to D with chalk line

(NOTE: You have now established the perimeter of the building. See Figure 27.)

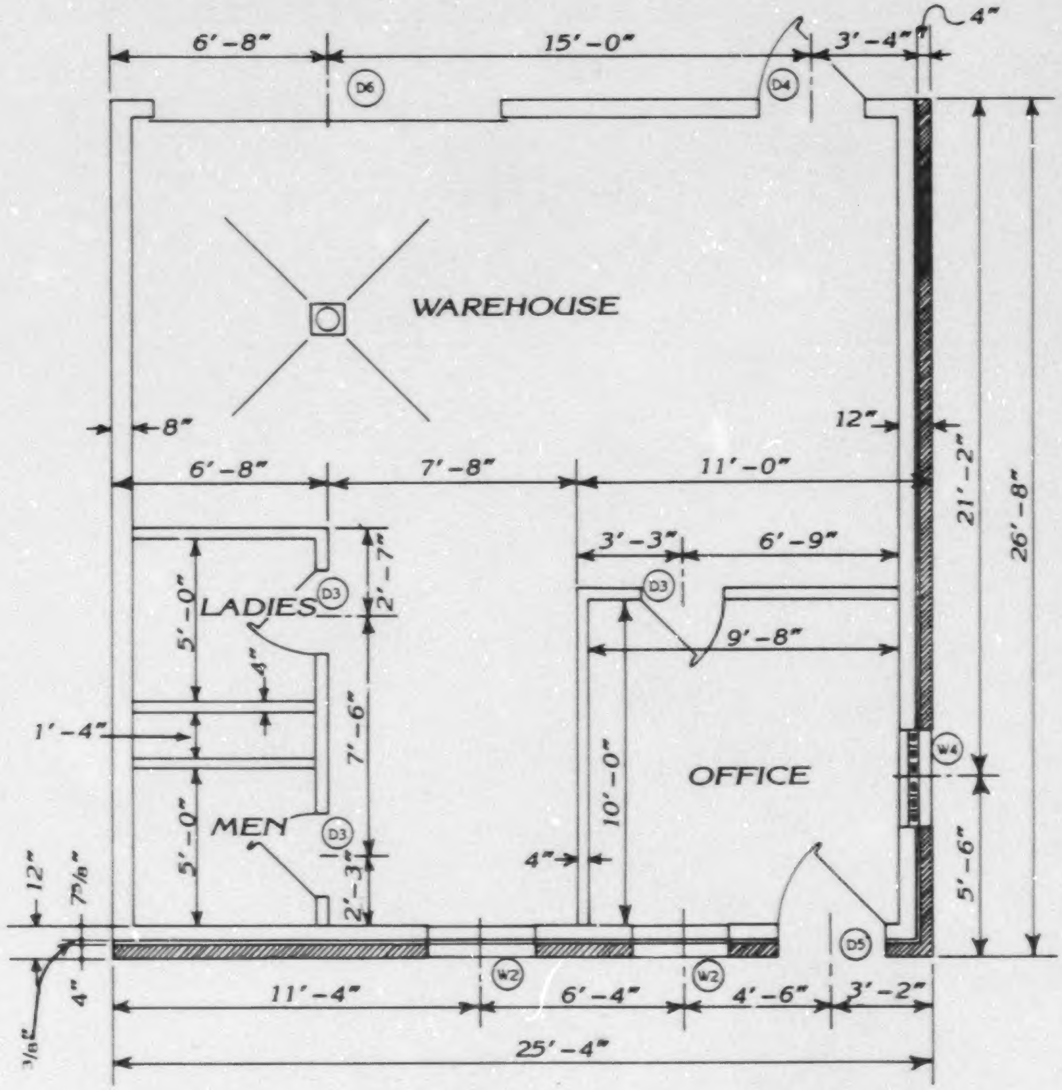
FIGURE 27


Point C
Point D
N
26' – 8"
Point A
Point B
25' – 4"

G. Clean up work area and put away equipment and materials, or measure and lay out inside dimensions shown on floor plan as directed by your instructor

JOB SHEET #1

FIGURE 28


6'-8"
15'-0"
3'-4"
4"
D6
D4
WAREHOUSE
8"
12"
6'-8"
7'-8"
11'-0"
21'-2"
26'-8"
3'-3"
6'-9"
D3
LADIES
2'-7"
5'-0"
4"
9'-8"
1'-4"
7'-6"
10'-0"
OFFICE
W4
MEN
D3
4"
5'-6"
12"
7/8"
2'-3"
D5
W2
W2
4"
3/8"
11'-4"
6'-4"
4'-6"
3'-2"
25'-4"

FLOOR PLAN

SCALE: 3/16" = 1'-0"

MEASURING
UNIT II

TEST

NAME ______________________________ SCORE ______________

1. Match to their correct definitions terms associated with measuring. Write the correct numbers in the blanks.

______a. Arrangement of lines to indicate the actual size for constructing the object or structure represented

______b. Parts or sections on a rule that make up 1 inch

______c. Unit of measure consisting of twelve equal parts called *inches*

______d. Part of a whole; represents one or more equal parts of a unit

______e. Smallest whole unit of lineal measure commonly used

______f. Type of colored marking crayon used in construction

______g. Plan or design of the project to be constructed

______h. Relating to, consisting of, or resembling a straight line

______i. Setting of limits or bounds according to a predetermined standard

______j. Outer limits or boundaries

______k. Measuring instrument graduated in whole units and fractions of units

______l. Tightly stretched; not slack

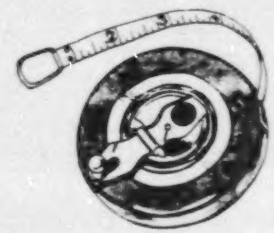
______m. Marks on a rule or tape indicating measurements

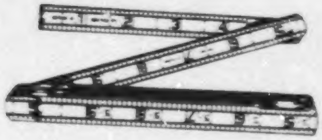
1. Lineal
2. Inch
3. Divisions
4. Rule
5. Foot
6. Perimeter
7. Keel
8. Taut
9. Dimensions
10. Layout
11. Fraction
12. Measuring
13. Graduations

TEST

2. Identify the following basic measuring tools used by carpenters. Write the correct names in the blanks.

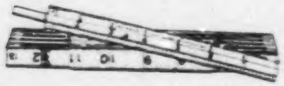
Sixteen-foot steel tape
One-hundred-foot steel tape
Spring-balanced tape tension handle
Speed square
Engineer's folding rule
Steel framing square
Carpenter's folding rule
Combination square
Two-hundred-foot steel tape and reel

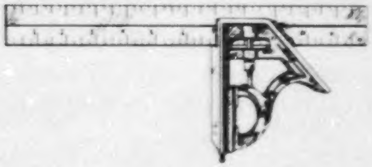




a. ______________________________

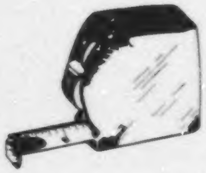
b. ______________________________

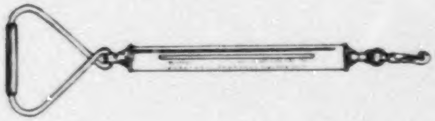




c. ______________________________

d. ______________________________

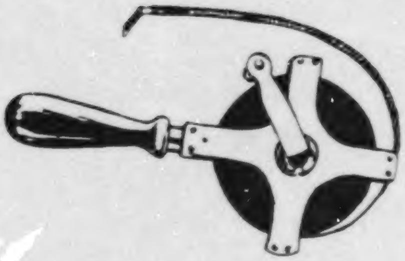


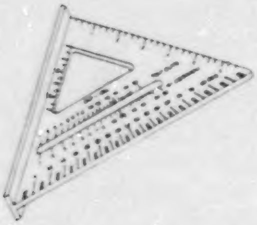


e. ______________________________

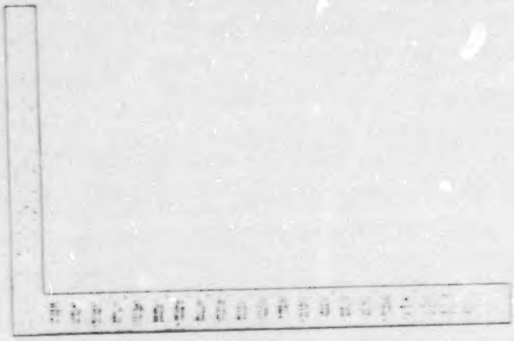
f. ______________________________

TEST





g. ______________________ h. ______________________



i. ______________________

3. List five common errors that contribute to incorrect measurements.

a. ______________________

b. ______________________

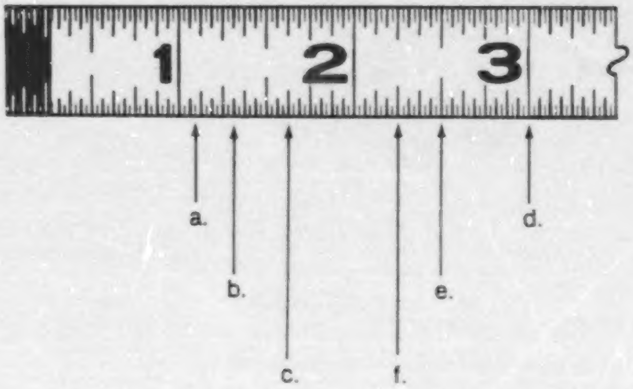
c. ______________________

d. ______________________

e. ______________________

TEST

4. Identify graduations on the carpenter's rule illustrated below. Write the correct names in the blanks.



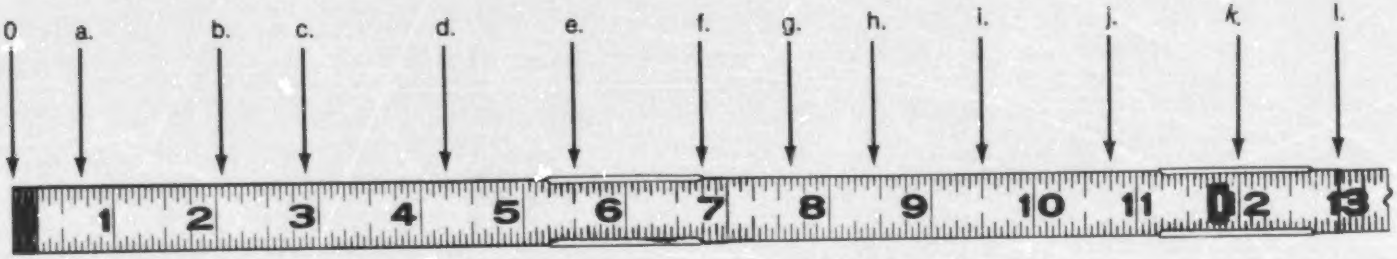
a. ______________________________ b. ______________________________

c. ______________________________ d. ______________________________

e. ______________________________ f. ______________________________

TEST

5. Read the carpenter's rule illustrated below to the nearest fraction of an inch. Start each reading from the 0 end of the rule. Write the correct graduations in the corresponding blanks.


0
a.
b.
c.
d.
e.
f.
g.
h.
i.
j.
k.
l.
1
2
3
4
5
6
7
8
9
10
11
12
13

a. ____________________

b. ____________________

c. ____________________

d. ____________________

e. ____________________

f. ____________________

g. ____________________

h. ____________________

i. ____________________

j. ____________________

k. ____________________

l. ____________________

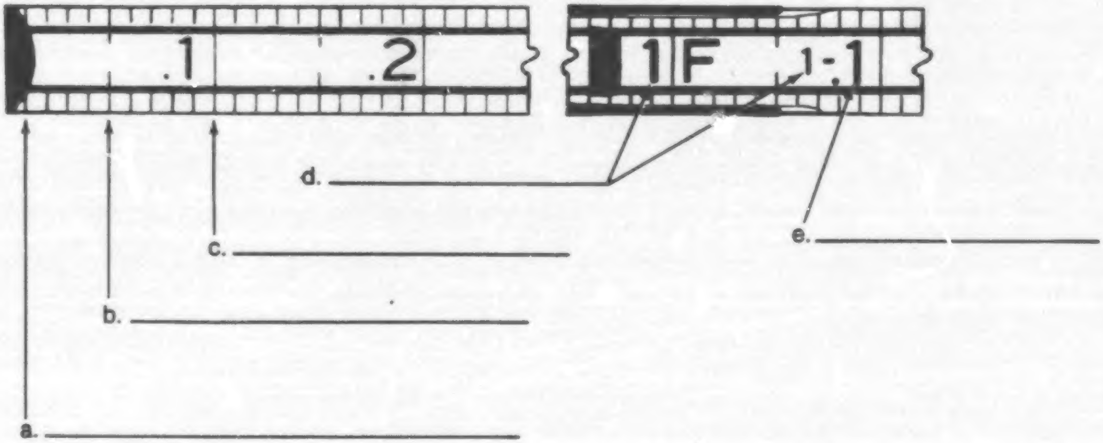
TEST

6. Convert the following fractional inches to hundredths of a foot. Write the correct answers in the blanks. Show your work.

__________a. 1/8"   __________b. 1 7/8"   __________c. 6 5/8"

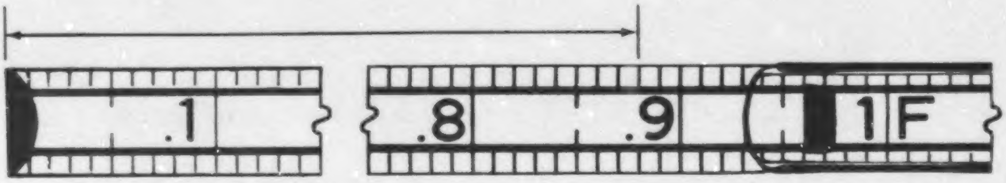
__________d. 1"   __________e. 2 3/8"   __________f. 11 1/2"

7. Identify graduations on the engineer's rule illustrated below. Write the correct names in the blanks.

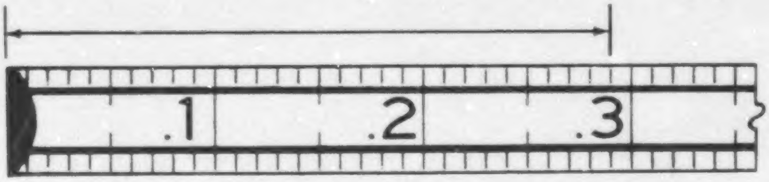


TEST

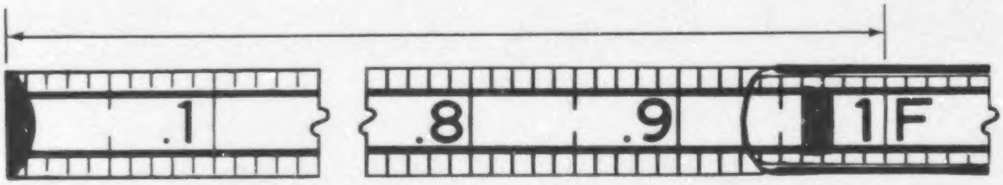
8. Read the engineer's rules illustrated below to the nearest hundredths of an inch. Write the correct answers in the blanks.



a. ______________________________

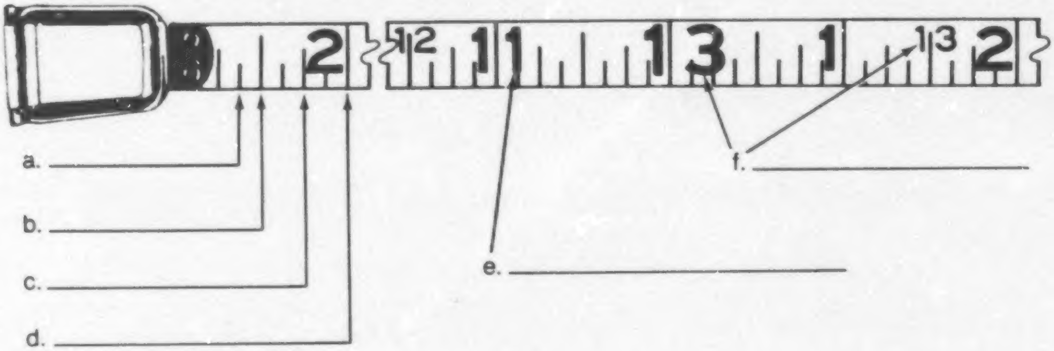


b. ______________________________



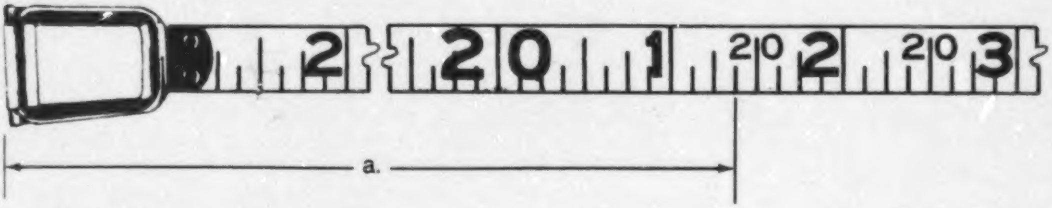
c. ______________________________

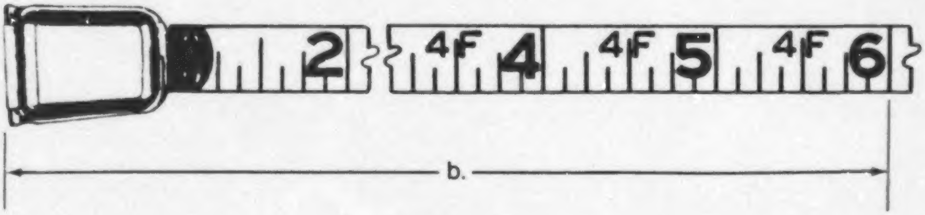
9. Identify graduations on the tape illustrated below. Write the correct names in the blanks.

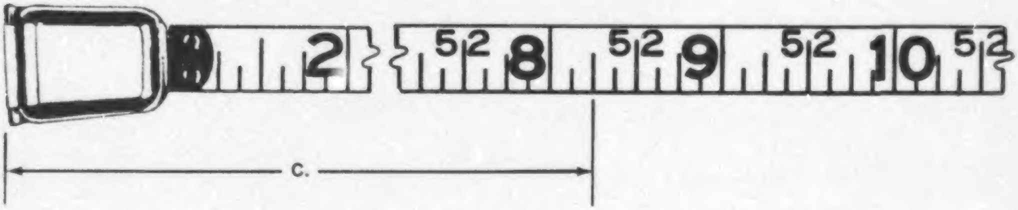

2
2
3
2
a. ______
b. ______
c. ______
d. ______
e. ______
f. ______

TEST

10. Read the tapes illustrated below to the nearest fraction of an inch. Write the dimensions on the arrows between the reference lines.


2
20
1
20 2
20 3
a.


2
4F 4
4F 5
4F 6
b.


2
52 8
52 9
52 10
52
c.

11. Discuss measuring methods used to square lines.

a. 3-4-5 method — ____

____

____

____

TEST

b. Diagonal method — ____________________

____

____

____

(NOTE: Test questions 12 and 13 list the assignment and job sheets that are considered an important part of this test. If they have not been completed, check with your instructor.)

12. Measure objects.

13. Demonstrate the ability to use basic measuring tools and the 3-4-5 method to lay out the perimeter of a building on a concrete slab.

AMERICA'S INFRASTRUCTURE
UNIT II

ANSWERS TO TEST

1. a. 9
   b. 3
   c. 5
   d. 11
   e. 2
   f. 7
   g. 10
   h. 1
   i. 12
   j. 6
   k. 4
   l. 8
   m. 13

2. a. One-hundred-foot steel tape
   b. Engineer's folding rule
   c. Carpenter's folding rule
   d. Combination square
   e. Sixteen-foot steel tape
   f. Spring-balanced tape tension handle
   g. Two-hundred-foot steel tape and reel
   h. Speed square
   i. Steel framing square

3. Answer should include any five of the following

   a. Leaving slack in tape
   b. Not laying tape flat (tape is twisted or kinked)
   c. Not aligning tape or rule properly
   d. Not placing end of tape or rule on reference point
   e. Reading incorrect number
   f. Recording incorrect number
   g. Using wrong reference point
   h. Making errors in mathematical computations
   i. Using incorrect measuring tool for job being performed

4. a. Thirty-seconds
   b. Sixteenths
   c. Eighths
   d. Inches
   e. Halves
   f. Quarters or fourths

5. a. 11/16"
   b. 2 1/16"
   c. 2 7/8"
   d. 4 1/4"
   e. 5 1/2"
   f. 6 3/4"
   g. 7 5/8"
   h. 8 7/16"
   i. 9 1/2"
   j. 10 3/4"
   k. 12" or 1' – 0"
   l. 13" or 1' – 1"

ANSWERS TO TEST

6.
   a. .01
   b. .15
   c. .55
   d. .08
   e. .20
   f. .96

7.
   a. Hundredths
   b. Five-hundredths
   c. Tenths
   d. Foot numbers
   e. Tenth number

8.
   a. .88
   b. .29
   c. 1.00 or 1'

9.
   a. Eighth inch
   b. Half inch
   c. Quarter inch
   d. Inch
   e. Inch number
   f. Foot numbers

10.
   a. 20' – 1 3/8"
   b. 4' – 6" or 4 1/2'
   c. 52' – 8 1/4"

11. Discussion should include the following

    a. 3-4-5 method — Forming a right triangle using largest multiple of 3-4-5 feet (6-8-10, 12-16-20, 24-32-40, etc.) possible for length of lines being squared, and ensuring that longest side of triangle is exact appropriate multiple of 5

    b. Diagonal method — Measuring diagonally from inside corners of layout and ensuring that diagonal lines are equal in length

12. Evaluated to the satisfaction of the instructor

13. Performance skills evaluated to the satisfaction of the instructor

PLAN READING

UNIT III

UNIT OBJECTIVE

After completing this unit, the student should be able to read plans and read and use an architect's scale. The student will show this knowledge by completing the assignment sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to—

1. Match terms associated with plan reading to their correct definitions.
2. Match to their correct descriptions types of drawings usually included in a set of plans.
3. List information found on types of drawings in a set of plans.
4. Match lines in the alphabet of lines to their correct uses.
5. Identify lines in the alphabet of lines.
6. Identify selected architectural symbols commonly used to represent materials on plans.
7. Identify selected electrical symbols commonly used on plans.
8. Identify selected mechanical symbols commonly used on plans.
9. Identify selected abbreviations commonly used on plans.
10. Match architect's conventions to their correct representations.
11. State the purposes of written specifications.
12. List basic information included in a set of written specifications.
13. Use an architect's scale.
14. Read plans.
15. Interpret a finish schedule.
16. Read written specifications.

PLAN READING
UNIT III

SUGGESTED ACTIVITIES

I. Unit contents

   A. Objective sheet

   B. Suggested activities

   C. Supplements

      1. Supplement #1 — Architectural Terms Commonly Found on Plans

      2. Supplement #2 — Crossword Puzzle of Architectural Terms and Abbreviations

      3. Supplement #3 — Self-Test on Application of Architectural Terms and Symbols

      4. Supplement #4 — Instructions for Concentration Game

   D. Transparency master: TM #1 — Architect's Scale

   E. Information sheet

   F. Assignment sheet supplements

      1. Assignment Sheet Supplement #1 — Plans

      2. Assignment Sheet Supplement #2 — Specifications

   G. Assignment sheets

      1. Assignment Sheet #1 — Read Plans

      2. Assignment Sheet #2 — Interpret a Finish Schedule

      3. Assignment Sheet #3 — Read Written Specifications

      4. Assignment Sheet #4 — Use an Architect's Scale

   H. Answers to assignment sheets

   I. Test

   J. Answers to test

SUGGESTED ACTIVITIES

II. Instructor's guide

A. Review unit and plan presentation.

B. Obtain materials to supplement unit.

1. Films

2. Sets of plans and written specifications for various structures

3. Examples of perspective, mechanical, and structural drawings

4. Pictures of different types of period construction

   EXAMPLES: Early American, Old English, Cape Cod, French

5. Transparencies and competency profiles

   (NOTE: Transparencies and competency profiles for this book are available from the Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074, or from The Associated General Contractors of America, 1957 E Street N.W., Washington, D.C. 20006; phone 202-393-2040.)

6. Architect's scales for each member of the class

7. Copy of latest edition of *Architectural Graphic Standards* by Ramsey and Sleeper

C. Make transparencies and additional copies of assignment sheets and supplements if needed.

D. Introduce unit.

SUGGESTIONS:

- Compare plan reading with planning a vacation or trip to another city using a road map.
- Ask questions about what is necessary to build a home or commercial building. Point out that plans provide detailed drawings and that plans and specifications contain all information necessary to complete a job successfully.
- Invite an architect to the class to discuss architect's drawings and plans.

E. Provide students with objective sheet; discuss unit and specific objectives.

F. Provide students with information and assignment sheets.

SUGGESTED ACTIVITIES

G. Discuss information and assignment sheets.

1. Use Information Sheet, Section I to discuss terms associated with plan reading.

   SUGGESTIONS:

   - Provide students with copies of Supplement #1, "Architectural Terms Commonly Found on Plans."
   - When discussing nominal and actual dimensions, have students measure a concrete block, 2 x 4, or other piece of lumber to illustrate the difference between nominal and actual dimensions.
   - Show students examples of perspective, mechanical, and structural drawings when discussing these terms.

2. Use Information Sheet, Sections II and III to discuss the types of drawings usually included in a set of plans.

   SUGGESTIONS:

   - Have students briefly review each drawing in the set of plans in Assignment Sheet Supplement #1 so that they can recognize each type of construction plan.

     (NOTE: Students will refer to each plan in this set when studying other sections of the information sheet and when completing the assignment sheets.)

   - Show students examples of perspective, mechanical, and structural drawings.

3. Use Information Sheet, Sections IV and V to discuss and illustrate the alphabet of lines.

   SUGGESTION:

   - Select a drawing from the plans in Assignment Sheet Supplement #1 at the end of the Information Sheet, or use one obtained to supplement the unit, and have students identify the different lines on the plan.

4. Use Information Sheet, Sections VI through VIII to discuss and illustrate symbols commonly used on plans.

   SUGGESTIONS:

   - Select a drawing from the set of plans in Assignment Sheet Supplement #1, or use one obtained to supplement the unit, and have students identify symbols found on the plan.

SUGGESTED ACTIVITIES

- Use the mechanical drawing obtained to supplement the unit to point out the various electrical and mechanical symbols used on plans.

- Use Supplement #4, "Instructions for Concentration Game," to develop a concentration game for review of symbols.

- Have students review architectural symbols for materials by completing Supplement #3, "Self-Test on Application of Architectural Terms and Symbols."

5. Use Information Sheet, Section IX to discuss abbreviations commonly used on plans.

   SUGGESTIONS:

   - Develop a set of flash cards containing the various abbreviations. Have students use the cards in teams, or show the class the cards and have individuals give you the correct answers.

   - Select a drawing from the set of plans in Assignment Sheet Supplement #1, or use one obtained to supplement the unit, and have students identify the abbreviations on it.

   - Have students review terms and abbreviations by completing Supplement #2 crossword puzzle.

   - Have students complete Assignment Sheets #1 and #2. Critique and discuss in class.

6. Use Information Sheet, Section X to discuss conventions used by architects.

   SUGGESTIONS:

   - Invite an architect to the class to discuss and demonstrate the conventions used in architect's drawings.

   - Select a drawing from the set of drawings in Assignment Sheet Supplement #1, or use one obtained to supplement the unit, to illustrate conventions.

7. Use Information Sheet, Sections XI and XII to discuss written specifications.

   SUGGESTIONS:

   - Point out that the description of materials in Assignment Sheet Supplement #2, "Specifications," is only part of a set of specifications for a particular residential building.

SUGGESTED ACTIVITIES

- Prepare a bulletin board showing the relationships between plans and written specifications.
- Have students complete Assignment Sheet #3. Critique and discuss in class.
- Provide students with specifications for a building in your community. Discuss.
- Invite a contractor to the class to explain how bids are made based on plans and written specifications for a building.

8. Use Information Sheet, Section XIII and Assignment Sheet #4 to discuss reading the architect's scale.

SUGGESTIONS:

- Provide each student with an architect's scale.
- Use Transparency #1 to illustrate the architect's scale.
- Have students complete Assignment Sheet #4 so that they may practice reading the different scales on an architect's scale.
- Have students use *Architectural Graphic Standards* to learn the different dimensioning systems.

9. Visit construction sites that are in different phases of construction. Obtain construction plans so that students can read the plans to determine the next steps to be taken.

H. Give test.

I. Critique test and discuss in class.

J. Reteach if necessary.

K. Complete appropriate section of competency profiles.

III. References

A. Dalzell, Ralph J. *Blueprint Reading for Home Builders.* New York: McGraw-Hill Book Company, Inc., 1955.

B. Hendrix, Laborn J. "Bud." *Bricklaying Curriculum, Basic Core.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, and The Associated General Contractors of America, 1983.

SUGGESTED ACTIVITIES

C. Hendrix, Laborn J. "Bud." *Millwright Instructional Materials*. Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, and The Associated General Contractors of America, 1980.

D. Hepler, Donald E., and Paul J. Wallach. *Architectural Drafting and Design*, 3rd ed. New York: McGraw-Hill Book Company, Inc., 1977.

E. Ramsey, Charles G., and Harold R. Sleeper. *Architectural Graphic Standards*, 6th ed. Edited by Joseph N. Boaz. New York: John Wiley and Sons, Inc., 1970.

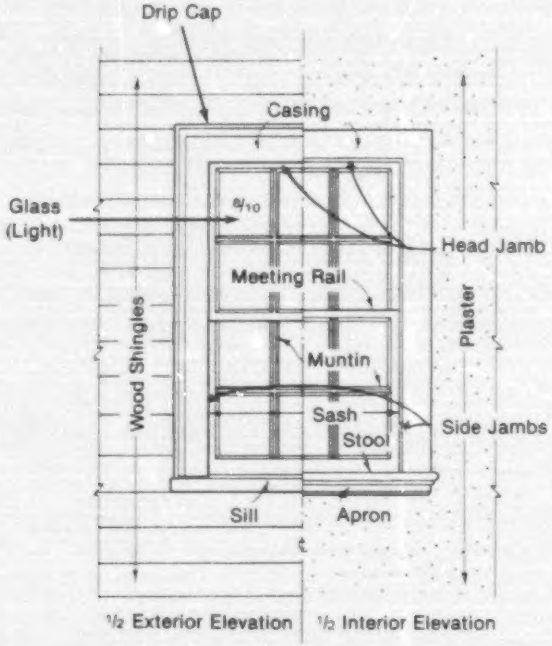
F. Sundberg, Elmer W. *Building Trades Blueprint Reading*, 4th ed. Chicago, Illinois: American Technical Society, 1967.

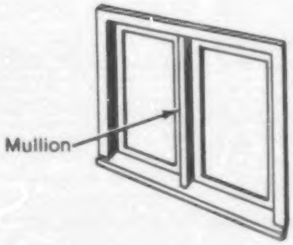
G. Wagner, Willis H. *Modern Carpentry*. South Holland, Illinois: The Goodheart-Willcox Co., Inc., 1976.

SUGGESTED ACTIVITIES

SUPPLEMENT #1 — ARCHITECTURAL TERMS COMMONLY FOUND ON PLANS

Window terms


Drip Cap
Casing
Glass
(Light)
8/10
Head Jamb
Meeting Rail
Plaster
Wood Shingles
Muntin
Sash
Side Jambs
Stool
Sill
Apron
½ Exterior Elevation
½ Interior Elevation



Adapted from *Blueprint Reading for Home Builders* by J. Ralph Dalzell, 1955, published by McGraw-Hill Book Company, Inc., New York.

Drip cap — Projection of masonry or wood on outside top of window to protect window from rain

Muntin — Strip of wood or metal that separates and supports the panes of glass in a window sash

Meeting rail — Horizontal center rail of a sash in double-hung windows

Sash — Part of a window in which panes of glass are set; generally movable as in double-hung windows; the two side pieces are called *stiles* and the upper and lower pieces are called *rails*

Side jambs — Vertical sideposts used in the framing of a window or doorway

Head jamb — Horizontal top post used in the framing of a window or doorway

SUPPLEMENT #1

Sill — Horizontal member at the bottom of a window or doorway

Lintel — Horizontal structural member supporting a wall over a window or other opening

Stop bead — Strip on window frame against which the sash slides

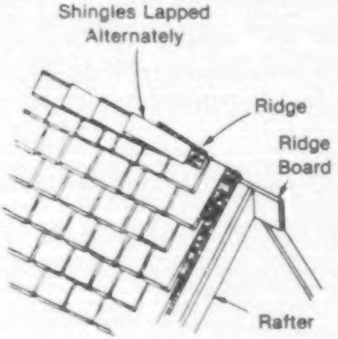
Mullion — Large, vertical division of a window opening

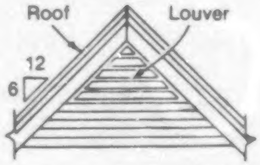
Stool — Flat, narrow shelf forming the top member of the interior trim at bottom of a window

Apron — Plain or molded piece of finish below the stool of a window; put on to cover the rough edge of the plastering

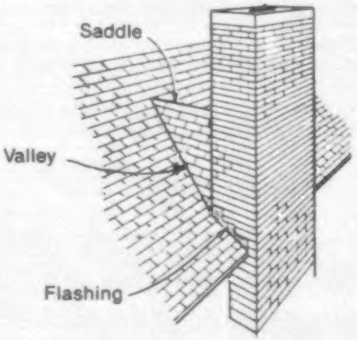
Light — Pane of glass or window glass

Pitched roof terms





Gable



Adapted from *Blueprint Reading for Home Builders* by J. Ralph Dalzell, 1955, published by McGraw-Hill Book Company, Inc., New York.

Ridge — Top edge of roof where the two slopes meet

Ridge board — Board placed on edge at ridge of roof to support upper ends of rafters

Louver — Opening for ventilation covered by sloping slats to exclude rain

Saddle — Tent-shaped portion of roof between chimney and main part of roof; built to support flashing and to direct water away from chimney

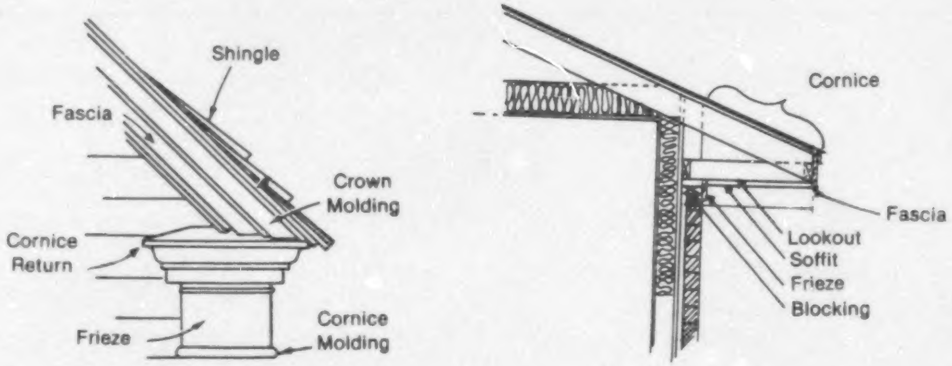
Valley — Intersection of the bottom two inclined sides of a roof

Flashing — Sheet metal, copper, lead, or tin used to cover open joints to make them waterproof

Gable — The end of a ridged roof as distinguished from the front or rear side

SUPPLEMENT #1

Cornice terms


Shingle
Fascia
Crown Molding
Cornice Return
Frieze
Cornice Molding
Cornice
Fascia
Lookout
Soffit
Frieze
Blocking

Adapted from *Blueprint Reading for Home Builders* by J. Ralph Dalzell, 1955, published by McGraw-Hill Book Company, Inc., New York.

Cornice — Part of roof that projects beyond a wall

Cornice return — Short portion of cornice carried around corner of structure

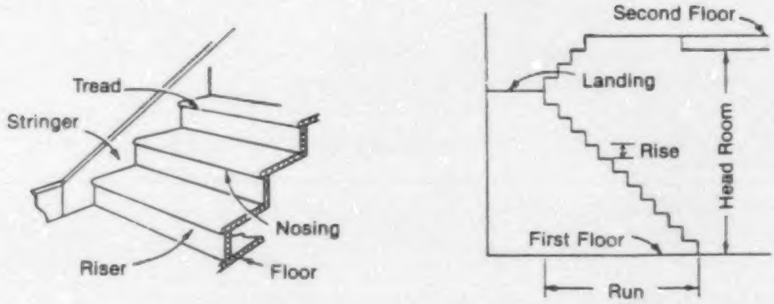
Fascia — Outside flat member of a cornice

Crown molding — Molding at top of cornice and just under roof

Soffit — Underside of cornice

Frieze — Trim member used just below cornice

Stair terms


Tread
Stringer
Nosing
Riser
Floor
Second Floor
Landing
Rise
Head Room
First Floor
Run

Adapted from *Blueprint Reading for Home Builders* by J. Ralph Dalzell, 1955, published by McGraw-Hill Book Company, Inc., New York.

SUPPLEMENT #1

Tread — Horizontal part of a step on which the foot is placed

Stringer — Supporting timber at sides of staircase

Riser — Vertical portion of a step

Nosing — Overhanging edge of a stair tread

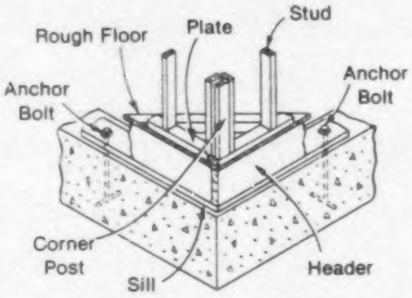
Landing — Horizontal floor area between flights of steps

Run — Horizontal distance covered by a flight of steps; also net width of a step

Rise — Vertical distance from top of a tread to top of next highest tread

Head room — Distance between flights of steps or between steps and ceiling above

Structural terms



Used from *Blueprint Reading for Home Builders* by J. Ralph Dalzell, 1955, published by McGraw-Hill Book Company, Inc., New York.

Anchor bolt — Bolt with threaded portion projecting from structure; generally used to hold frame of a building secure against wind load

(NOTE: Anchor bolts may also be called *hold-down bolts, foundation bolts,* or *sill bolts.*)

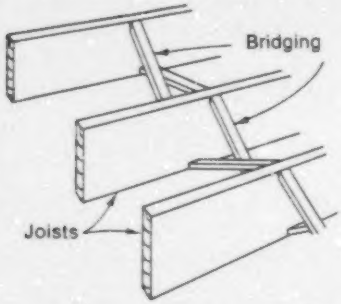
Sill — Horizontal member supported by a foundation wall or piers, and which in turn bears the upright members of a frame

Plate — Structural member with a depth substantially smaller than its length or width

Stud — One of a series of vertical slender wood or metal members used to support elements in walls and partitions

SUPPLEMENT #1

Header — Wood beam set at right angle to joist to provide seat or support



Used from *Blueprint Reading for Home Builders* by J. Ralph Dalzell, 1955, published by McGraw-Hill Book Company, Inc., New York.

Joist — Heavy piece of horizontal timber to which the boards of a floor or the lath of a ceiling is nailed

(NOTE: Joists are laid edgewise to form a floor support; they rest on the wall or on girders.)

Bridging — Process of bracing floor joists by fixing lateral members between them

Footing — Foundation for a column; enlargement at the bottom of a wall to distribute the weight of the superstructure over a greater area to prevent settling

Expansion joint — Separation between adjoining parts to allow for small relative movements such as those caused by temperature changes

Rake — Trim members that run parallel to roof slope and form the finish between roof and wall at gable end (See Detail Sheet #8 in Assignment Sheet Supplement #1)

Veneer — Covering layer of material for a wall; facing materials applied to the external surface of steel, reinforced concrete, or frame walls

Battens — Narrow strips of wood or metal used to cover vertical joints between boards and panels

Batt — Type of insulation designed to be installed between framing members

Reinforced concrete — Concrete containing metal rods, wires, or other slender members in such a manner that concrete and metal act together to resist forces

Stem wall — That portion of foundation that rests on the footing

Vapor barrier — Material used to retard the flow of vapor or moisture into walls or floor and thus prevent condensation within them

SUPPLEMENT #1

Girder — Main supporting beam, either timber or steel, used for supporting a superstructure

Furring — Strips of wood or metal applied to a wall or other surface to make it level, form an airspace, or to provide a fastening surface for a finish covering

Camber — Concave or convex curvature of a surface

Beam — One of the principal horizontal members of a building

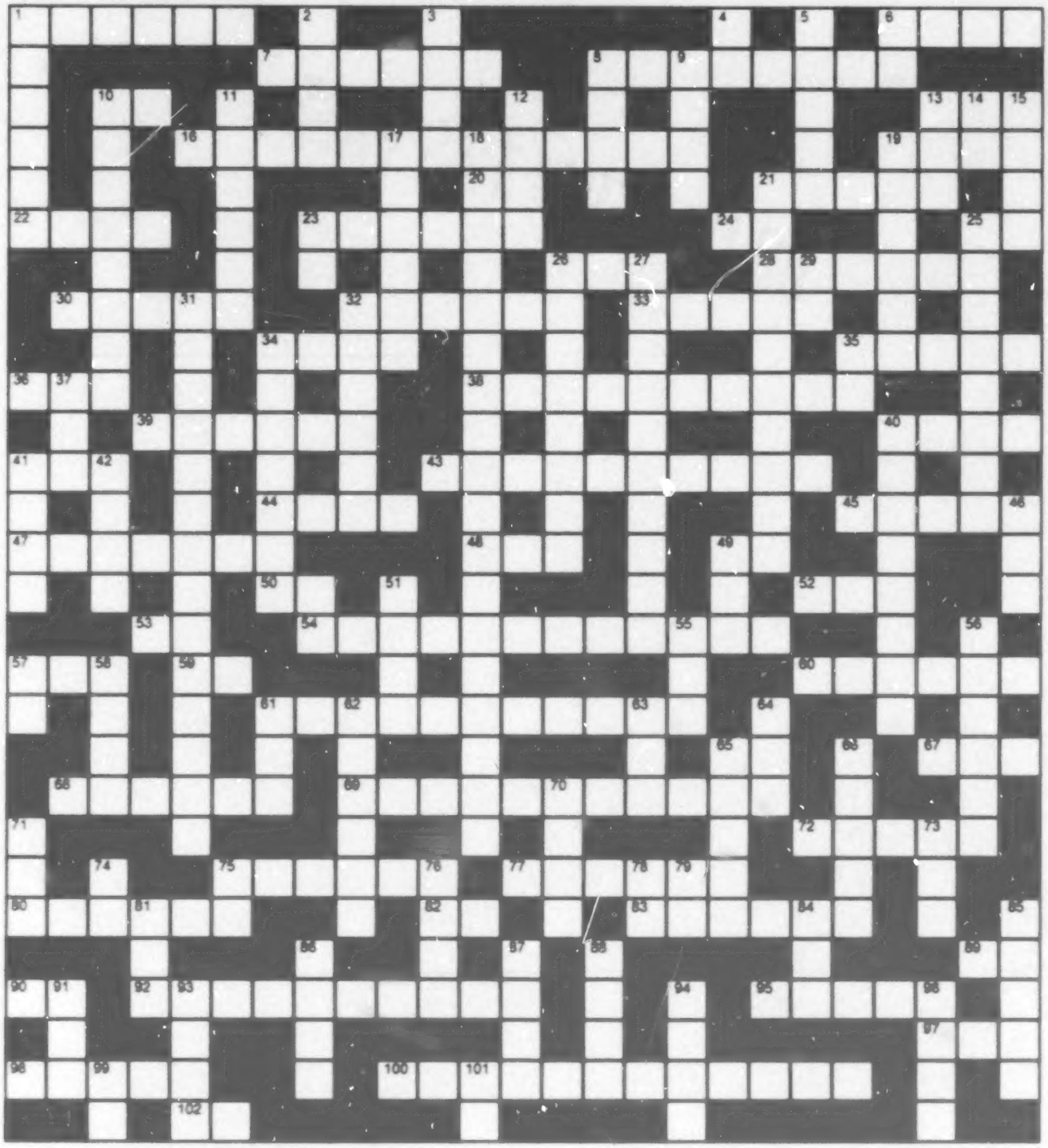
Slab — Poured concrete floor

Monolithic — Continuous mass of concrete cast as a single unit

SUGGESTED ACTIVITIES

SUPPLEMENT #2 — CROSSWORD PUZZLE OF ARCHITECTURAL TERMS AND ABBREVIATIONS

Review the terms in Supplement #1 and the abbreviations listed in Section IX of the Information Sheet, and then test yourself by completing the crossword puzzle below. Clues and solution are on the following pages.



SUPPLEMENT #2

ACROSS

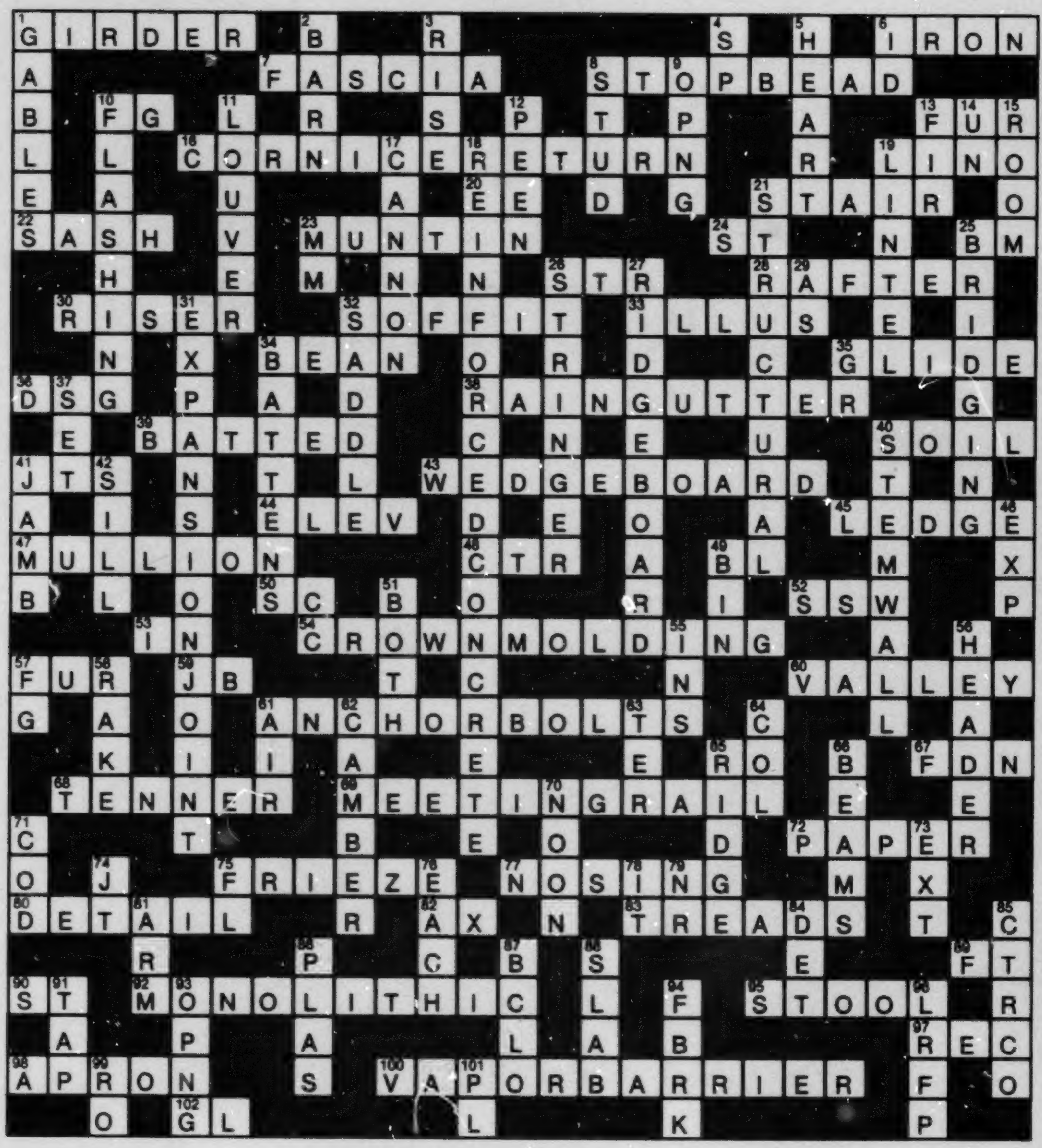
1. Main supporting beam
6. Galvanized material used in flashing
7. Outside flat member of cornice
8. Strip against which window sash slides (2 wds)
10. Finish grade (abbr)
13. Furring (abbr)
16. Cornice portion carried around corner (2 wds)
19. Linoleum (abbr)
20. Electrical engineer (abbr)
21. Step
22. Window part in which panes of glass are set
23. Wood or metal strip that separates panes of glass in window
24. Steel (abbr)
25. Bench mark (abbr)
26. Structural (abbr)
28. Structural member designed to support roof loads
30. Vertical portion of step
32. Underside of cornice
33. Illustration (abbr)
34. Lima, green, or navy
35. Slide smoothly
36. Double-strength glass (abbr)
38. Eave channel to catch and carry off rainwater
39. Installed insulation batts
40. Earth
41. Joints (abbr)
43. Wood used to adjust elevation, tighten framework, etc. (2 wds)
44. Elevation (abbr)
45. Shelf-like projection from wall
47. Large, vertical division of window opening
48. Center or counter (abbr)
49. Building line (abbr)
50. Scale (abbr)
52. South southwest (abbr)
53. Inch (abbr)
54. Molding at top of cornice just under roof (2 wds)
57. Furred (abbr)
59. Jamb (abbr)
60. Intersection of bottom and two inclined sides of roof
61. Threaded fasteners used to hold frame of building secure (2 wds)
65. Rough opening (abbr)
67. Foundation (abbr)
68. Tenpenny nail (slang)
69. Horizontal center bar of a double-hung window
72. Wallpaper (sl)
75. Trim member used just below cornice
77. Overhanging edge of stair tread
80. Larger scale graphic of part of another drawing
82. Tool used for chopping
83. Horizontal parts of a step
89. Foot (abbr)
90. Stone (abbr)
92. Continuous mass of concrete cast as a single unit
95. Flat, narrow part of interior trim at bottom of window
97. Recessed (abbr)
98. Piece of finish below stool of window
100. Material used to prevent condensation within walls
102. Pane of glass (abbr)

DOWN

1. Ends of ridged roofs
2. Farm building
3. Vertical distance from top of tread to top of another tread
4. Soil pipe (abbr)
5. Valentine symbol
6. Inside diameter (abbr)
8. Slender wood or metal support member used in walls
9. Opening (abbr)
10. Waterproof material used to cover open joints
11. Slatted ventilation opening
12. Ball-shaped hammer head
13. Wood widely used for flooring and sheathing
14. Prefix for *not*
15. Interior space enclosed by walls
17. Weapon that fires large balls
18. Concrete containing material that makes it more resistant (2 wds)
19. Horizontal structural member supporting wall over an opening
21. Type of plan drawn for large buildings
23. Millimeter (abbr)
25. Bracing floor joists by fixing lateral members between them
26. Supporting timber at sides of staircase
27. Board placed on edge at ridge of roof (2 wds)
29. Architectural standard (abbr)
31. Separation between adjoining parts to allow for movement (2 wds)
32. Tent-shaped portion between roof and chimney
34. Narrow strips of wood or metal used to cover vertical joints
35. Grade (abbr)
37. What concrete has done when it has lost its elasticity
40. Portion of foundation that rests on footing (2 wds)
41. Vertical sidepost of a window
42. Horizontal member at bottom of window
46. Expansion (abbr)
49. Storage box
51. Each of two
55. Insulation (abbr)
56. Wood beam set at right angle to joist
57. Finish grade (abbr)
58. Trim members that form finish between roof and wall at gable
61. Type of duct
62. Concave or convex curvature of surface
63. Terrace (abbr)
64. Column (abbr)
65. Top edge of roof where two slopes meet
66. Principle horizontal members of building
70. Lunch time
71. Clean-out door (abbr)
73. Exterior (abbr)
74. Joint (abbr)
75. Floor (abbr)
76. Every one
78. That
79. Not ready (abbr)
81. Limb
84. Detail (abbr)
85. Counter cutout (abbr)
86. Plaster (abbr)
87. Bathroom closet (abbr)
88. Poured concrete floor
91. Faucet
93. Opening (abbr)
94. Firebrick (abbr)
96. Living room fireplace (abbr)
99. Rough opening (abbr)
101. Plate (abbr)

SUGGESTED ACTIVITIES

SOLUTION TO SUPPLEMENT #2


1 GIRDER
6 IRON
7 FASCIA
8 STOPBEAD
10 FG
13 FUR
16 CORNICERETURN
19 LINO
20 EE
21 STAIR
22 SASH
23 MUNTIN
24 ST
25 BM
26 STR
28 RAFTER
30 RISER
32 SOFFIT
33 ILLUS
34 BEAN
35 GLIDE
36 DSG
38 RAINGUTTER
39 BATTED
40 SOIL
41 JTS
43 WEDGEBOARD
44 ELEV
45 LEDGE
47 MULLION
48 CTR
49 BL
50 SC
52 SSW
53 IN
54 CROWNMOLDING
57 FUR
59 JB
60 VALLEY
61 ANCHORBOLTS
65 RO
67 FDN
68 TENNER
69 MEETINGRAIL
72 PAPER
75 FRIEZE
77 NOSING
80 DETAIL
82 AX
83 TREADS
89 FT
90 ST
92 MONOLITHIC
95 STOOL
97 REC
98 APRON
100 VAPORBARRIER
102 GL

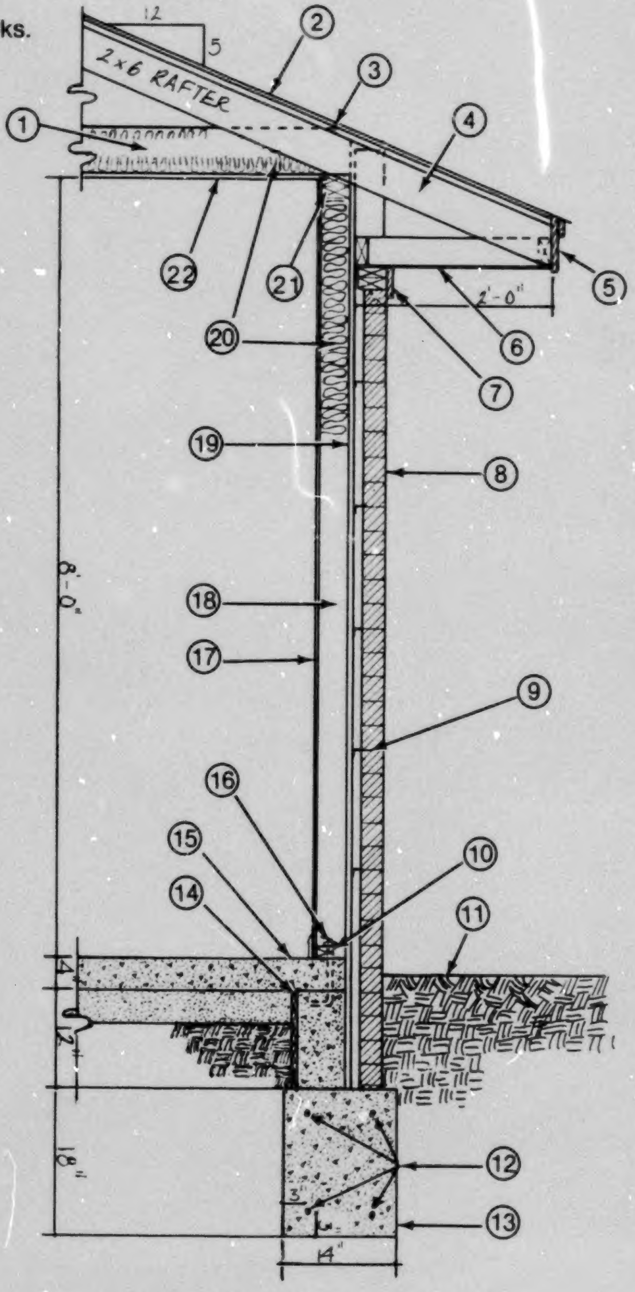
SUGGESTED ACTIVITIES

SUPPLEMENT #3 — SELF-TEST ON APPLICATION OF ARCHITECTURAL TERMS AND SYMBOLS

Test yourself on how well you understand architectural terminology and its application by identifying the various parts in the following section drawing below. Write the correct numbers in the blanks. Answers are given on the following page.

Write the correct numbers in the blanks.

______A. Brick
______B. Drywall
______C. Footing reinforcing rods
______D. Wall tie
______E. Grade line
______F. Top plate
______G. Sheathing
______H. Finish floor
______I. Stud
______J. Footing
______K. Roofing
______L. Perimeter insulation
______M. Anchor bolt
______N. Ceiling line
______O. Roof sheathing
______P. Wall and ceiling insulation
______Q. Fascia
______R. Ceiling joist
______S. Soffit
______T. Rafter
______U. Sole or bottom plate
______V. Frieze



ANSWERS TO SUPPLEMENT #3

A. 8
B. 17
C. 12
D. 9
E. 11
F. 21
G. 19
H. 15
I. 18
J. 13
K. 2
L. 14
M. 16
N. 22
O. 3
P. 20
Q. 5
R. 1
S. 6
T. 4
U. 10
V. 7

SUGGESTED ACTIVITIES

SUPPLEMENT #4 — INSTRUCTIONS FOR CONCENTRATION GAME

PURPOSE

Concentration provides the opportunity to eliminate the boredom of repetition in drilling students to learn the basics. It is an enjoyable classroom activity that allows students to match closely related terms and information.

(NOTE: Concentration is a classroom alternative that can be improvised with a very minimal investment of dollars and cents. The basic board can be personalized to address many group and individual learning needs in nearly every subject area.)

PREPARATION

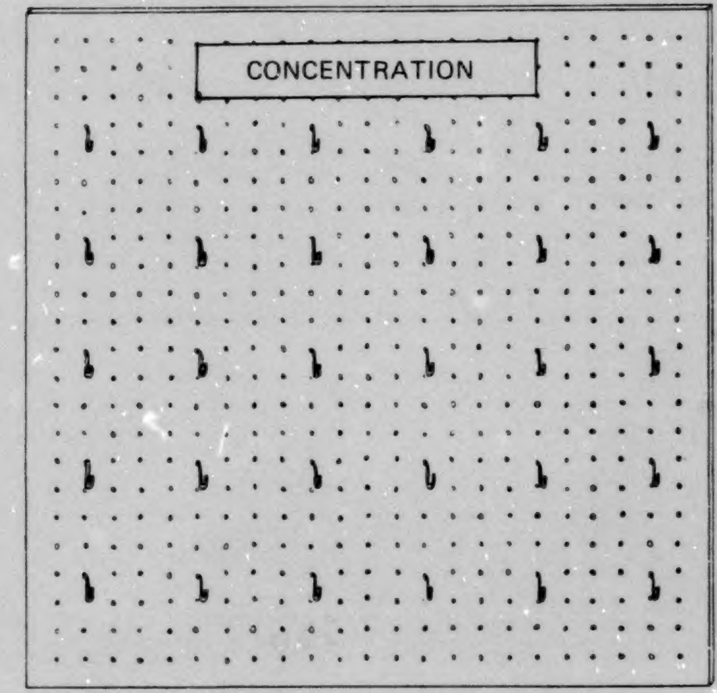
A. Gather the following materials to construct a basic Concentration board

Pegboard, 24 inches by 30 inches	Scissors
Pegboard hooks, approximately 30 to 36	Glue
Poster board or index cards, all one color	Hole punch
Spray paint, optional	

B. Paint the pegboard if desired, and allow to dry

C. Write the word CONCENTRATION on a piece of poster board and glue to the top of the pegboard

D. Position the pegboard hooks



SUPPLEMENT #4

E. Cut 3-by-5-inch cards from colorful poster board (cards should all be the same color), or use unlined index cards

F. Number one side of each card from 1 to 36, or adapt to twice the actual number of terms, items, and so on that the student will identify

G. Shuffle the numbered cards to mix the numbers, and then write terms, or paste or draw shapes, objects, or pictures on the unnumbered sides of the cards

(NOTE: If you want students to match terms to their definitions, write the terms and definitions on the cards, pairing each with a symbol such as a star, circle, etc. Another option is to add two or four wild cards that will match any combination. Be sure to pair every word, shape, object, or picture. Once the cards are made, they can double as flash cards or playing cards to involve students in pairs.)

H. Punch a hole in the top of each card, and place the cards on the hooks in numerical sequence, with the numbered side showing

PLAY

A. The beginning student or team selects two numbers

EXAMPLE: 2 and 27

B. If the words, shapes, objects, or pictures match the student or team earns a point, or has the opportunity to give a definition, or identify the object or picture to earn a point

C. If the cards match and the point is earned, the cards that match should remain turned out, with their numbers now facing the board

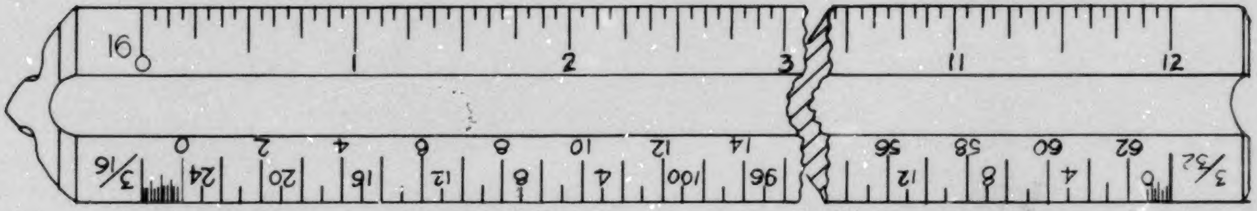
D. If the cards do not match, they are returned to their original playing position with numbers facing out, and the turn goes to the opposition

E. The game continues until the backs of all cards are revealed and matched

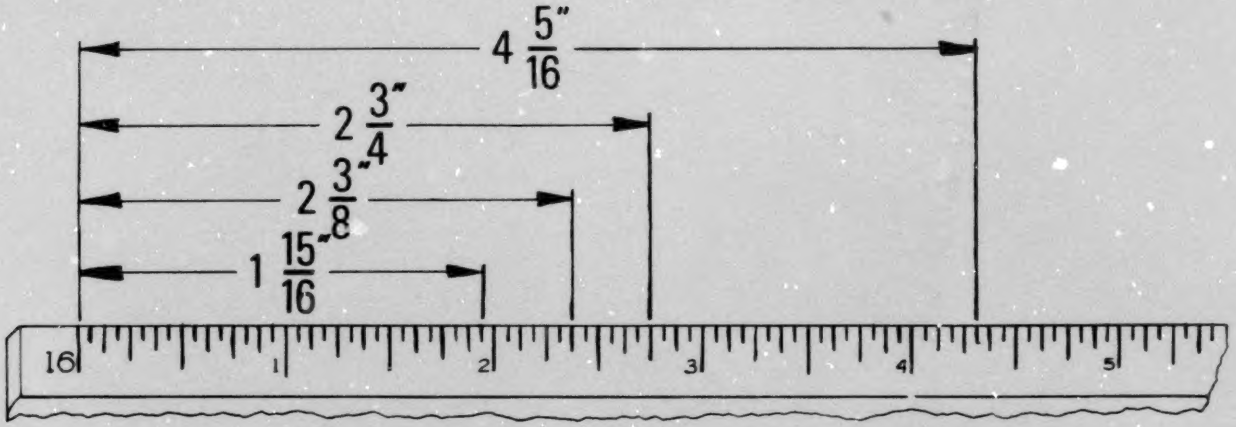
F. The student or team that provides the highest number of matches (points) wins the game

(NOTE: The instructor may want to present a reward or a token of accomplishment to the winning student or team.)

Architect's Scale


16
1
2
3
11
12
3/16
0
2
4
6
8
10
12
14
56
58
60
62
24
20
16
12
8
4
100
96
12
8
4
0
3/32

Measurements at Scale of 12" = 1'-0" (Full Scale)


4 5/16"
2 3/4"
2 3/8"
1 15/16"
16
1
2
3
4
5

PLAN READING
UNIT III

INFORMATION SHEET

I. Terms and definitions associated with plan reading

A. Architect's drawings — Set of detailed working drawings or plans drawn to scale by an architect, showing all information and dimensions necessary to build or remodel a structure; original drawings from which blueprints are made

(NOTE: The working drawings or architect's plans consist of several different kinds of drawings, usually assembled into a set: plot plan, foundation plan, floor plan[s], elevation drawings, section drawing[s], and detail drawings. The set will also include finish schedules and may include a perspective drawing, a structural drawing, and a mechanical drawing.)

B. Blueprints — Reproductions of architect's drawings; also called *plans* or *construction plans*

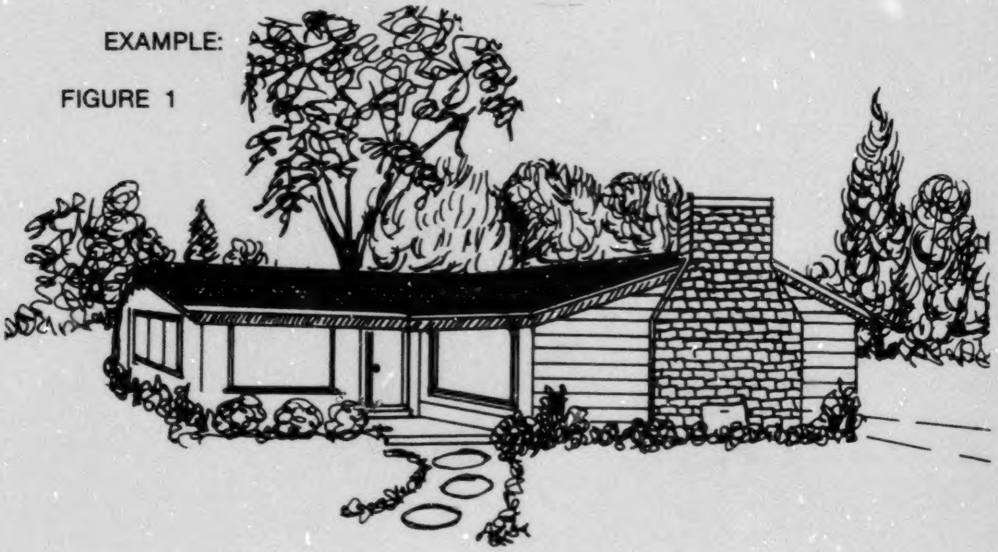
(NOTE: A true blueprint has white lines on a blue background; however, most of today's reproductions produce a black-, blue-, or sepia-colored line on a white background. See Assignment Sheet Supplement #1 at the end of the Information Sheet.)

C. Perspective drawing — Drawing having many of the features of a photograph; drawn by the architect to interest buyers (Figure 1)

(NOTE: Whenever perspective drawings are available, the carpenter should use them as an aid in visualizing the many details that appear on the construction plans.)

EXAMPLE:

FIGURE 1



INFORMATION SHEET

D. Structural drawing — Drawing by a structural engineer that may accompany architect's plans and that gives important information about the foundation, skeleton, and floor system

(NOTE: Structural plans are usually drawn for large structures such as an office building or factory. They include such details as heights of finished floors and walls; height and bearing of bar joist or steel joist; locations of bearing steel material; height of steel beams, concrete plank, concrete Ts, and poured-in-place concrete; bearing plate locations; location, size, and spacing of anchor bolts; and stairways.)

E. Mechanical drawing — Drawing showing location and details about plumbing and electrical components and heating and air-conditioning units

(NOTE: Mechanical features may be drawn on the basic floor or foundation plan or may be shown in separate drawings.)

F. Specifications — Detailed set of written instructions that supplements the set of plans, describes equipment and materials used in the structure, and becomes part of the contract (See Assignment Sheet Supplement #2 at end of Information Sheet)

G. Finish schedule — Listing or chart of parts (keyed to the plans), amounts, materials or products, and details (Figures 2 and 3)

(NOTE: Schedules may appear on same page as a plan or on a separate page in the set of plans. Schedules may be listed for windows, doors, room finishes, floor types and finishes, paint, appliances, fixtures, lintels, headers, and reinforcing steel. See Sheet #11 in Assignment Sheet Supplement #1 at end of Information Sheet.)

EXAMPLES:

FIGURE 2

DOOR SCHEDULE FOR ENTIRE HOUSE

MARK	SIZE	AMT REQ'D	REMARKS
A	5'-0" x 6'-8" x 1¾"	1	EXTERIOR FLUSH DOOR
B	2'-8" x 6'-8" x 1¾"	7	FLUSH DOORS 1-SLIDING 1-METAL CLAD
C	2'-6" x 6'-8" x 1⅜"	4	FLUSH DOOR
C_1	2'-6" x 6'-8" x 1⅜"	2	LOUVERED
D	2'-4" x 6'-8" x 1⅜"	4	FLUSH DOOR
D_1	2'-4" x 6'-8" x 1⅜"	1	LOUVERED
E	1'-3" x 6'-8" x 1⅜"	1	BIFOLD LOUVERED
F	2'-10" x 6'-8" x 1¾"	2	EXTERIOR 2 LIGHTS
G	2'-8" x 6'-8" x 1¾"	1	EXTERIOR 2 LIGHTS

FIGURE 3

WINDOW SCHEDULE

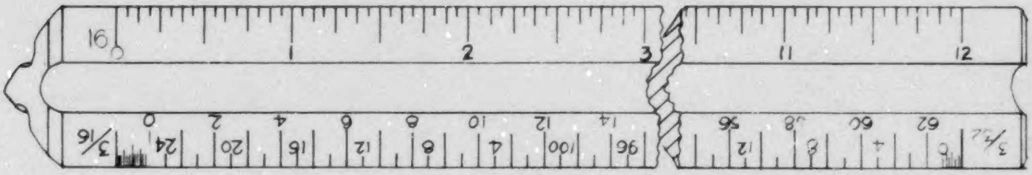
MARK	SIZE	REMARKS
A	(2) 3'-0" x 4'-2"	DH SEE SPECS
B	(2) 3'-0" x 3'-2"	"
C	—	TRIMLINE BAY 53R
D	2'-7" x 4'-2"	DH SEE SPECS
E	1'-6" x 3'-2"	"
F	2'-6" x 2'-9"	231B CASEMENT
G	3'-0" x 3'-2"	DH SEE SPECS
H	2'-0" x 5'-5"	FIXED SEE SPECS

INFORMATION SHEET

H. Architect's scale — Three-sided rule with six ruled faces designed to measure in twelve different scales of proportional feet and inches (Figure 4)

EXAMPLE:

FIGURE 4



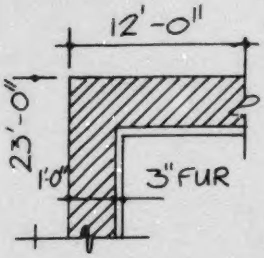
I. Scale drawing — Drawing made to a size either proportionally larger or smaller than the actual size of the object represented

(NOTE: The scale to which the architect makes a drawing is always indicated on the drawing, generally below the title. Detail and section drawings may be drawn on a larger scale than the other drawings in the set of plans.)

J. Convention — Architect's standard methods of representing dimensions and structural details (Figure 5)

EXAMPLE: Exterior solid brick wall

FIGURE 5



K. Visualization — Important aspect of plan reading that involves looking at and thinking about a structural detail, or a symbol for such a detail, and being able to form a mental picture of how such a detail is constructed or assembled

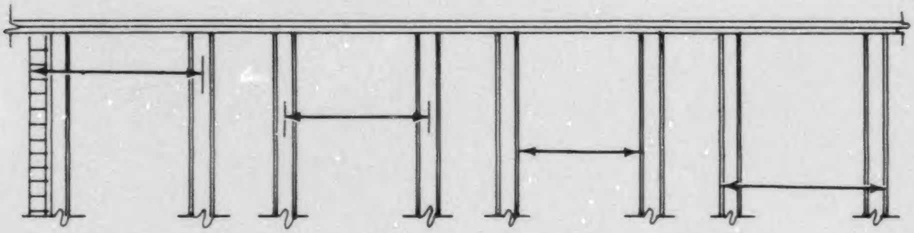
INFORMATION SHEET

L. Dimensioning — Using conventional dimension lines and figures to indicate actual sizes and distances of objects and spaces represented

(NOTE: Dimensioning may be from outside to center, center to center, wall to wall, or outside to outside. See Figure 6. In all cases, dimensions are given in full scale regardless of the fact that the plan shows an object or distance on a smaller scale. Section and detail views may use nominal sizes in labeling.)

EXAMPLE:

FIGURE 6


Outside to Center Center to Center Wall to Wall Outside to Outside

M. Nominal dimension — Approximate or rough size of a unit

EXAMPLES: 2×4 board, 8" × 8" × 16" concrete block

N. Actual dimension — Exact measured size of a unit

EXAMPLES: A 2×4 board is actually 3½ by 1½ inches; an 8" × 8" × 16" concrete block is actually 7⅝" × 7⅝" × 15⅝".

O. Elevation — Given grade

(NOTE: The use of the word *elevation* in this sense must not be confused with the elevation of a structure, which is a view of the outside of the structure.)

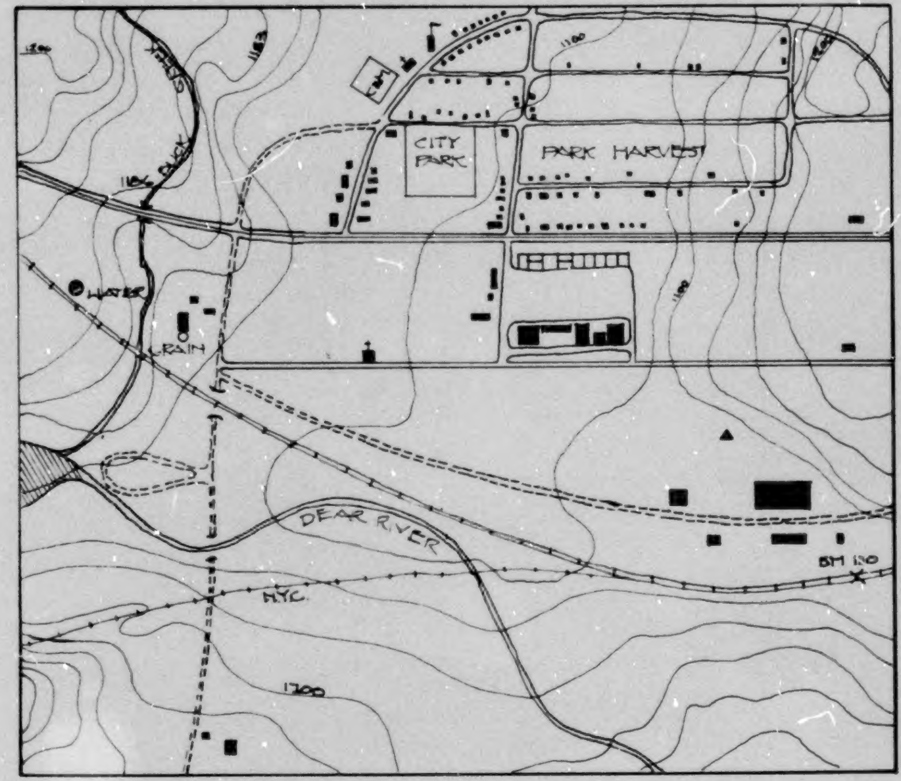
P. Bench mark — Point of known or assumed elevation used by surveyor as a reference point in determining other elevations

INFORMATION SHEET

Q. Topographical survey — Drawing of natural and man-made features of a place or region showing their relative positions and elevations (Figure 7)

EXAMPLE:

FIGURE 7


1200
1183
DUCK CREEK
1186
1100
CITY PARK
PARK HARVEST
WATER
GRAIN
1100
DEAR RIVER
N.Y.C.
1200
BM 1130

R. Contour lines — Lines used on plot plans and topographical surveys to show both natural grade and finish grade elevations (See Figure 7)

II. Descriptions of types of drawings usually included in a set of plans

A. Plot plan — Horizontal view showing where the building is to be located on the site (See Sheet #1 in Assignment Sheet Supplement #1)

B. Foundation plan — Horizontal view of entire masonry substructure below first floor or frame of building (See Sheet #2 in Assignment Sheet Supplement #1)

INFORMATION SHEET

C. Floor plan — Horizontal view of building, showing length and breadth of building and layout of rooms on that floor (See Sheet #3 in Assignment Sheet Supplement #1)

D. Elevation — Vertical, two-dimensional view of each of the exterior faces of a building, showing general shape and design of exterior and roof (See Sheets #4 and #5 in Assignment Sheet Supplement #1)

E. Section — Cut-away vertical view through an object or wall to show its interior makeup (See Sheet #6 in Assignment Sheet Supplement #1)

(NOTE: A section view is limited to the specific portion of the building the architect wishes to clarify, and may be drawn on the same sheet as an elevation or plan or may appear on a separate sheet.)

F. Detail — Graphic, at a larger scale, of part of another drawing, indicating special features of design, location, and composition and the correlation of the elements and materials shown (See Sheets #7 through #10 in Assignment Sheet Supplement #1)

(NOTE: Detail drawings often use the cut-away section view to show aspects that are too small to be shown in sufficient detail on plan or elevation drawings. Like section drawings, detail drawings may be drawn on the same sheet as an elevation or plan drawing or may appear on a separate sheet in the set of plans.)

III. Information found on types of drawings in a set of plans

A. Plot plan

1. Location, dimensions, and elevation of structure on site

2. Finished and existing grade contours

3. Property lines and dimensions

4. Location of utilities

5. Location of existing conditions

   EXAMPLES: Trees, utility buildings, other structures

6. Location and dimensions of driveways and walks

B. Foundation plan

1. Location and dimensions of footings, grade beams, foundation walls, stem walls, piers, equipment footings, foundations

2. Location of anchor bolts (in detail view)

INFORMATION SHEET

C. Floor plan

1. Outside walls, including location and dimensions of all exterior openings
2. Types of construction materials
3. Location of interior walls and partitions
4. Location and swing of doors
5. Stairways
6. Location of windows
7. Location of cabinets, electrical and mechanical equipment, fixtures
8. Location of cutting plane line

D. Elevation

1. Grade lines
2. Floor height
3. Window and door types
4. Roof lines and slope, roofing material, vents, gravel stops, projection of eaves
5. Exterior finish materials and trim
6. Exterior dimensions

E. Section

1. Details of construction and information about stairs, walls, chimneys, or other parts of construction that may not show clearly on plan
2. Floor levels in relation to grade
3. Wall thickness at various locations
4. Anchors and reinforcing steel

F. Detail

(NOTE: The following list itemizes types of information that may require a detail drawing. All of the items listed would never appear on a single detail drawing.)

1. Footings and foundations, including anchor bolts, reinforcing, control joints
2. Beams, floor joists, bridging, other support members
3. Sills, floor framing, exterior walls, vapor barriers
4. Floor heights, thickness, expansion, reinforcing

INFORMATION SHEET

5. Interior walls

6. Windows, exterior and interior doors, door frames

7. Roof, cornice, soffit, ceilings

8. Gravel stops, fascia, flashing

9. Fireplaces, chimneys

10. Staircases, stair assembly

11. Millwork, trim, ornamental iron, specialty items

IV. Uses of lines in the alphabet of lines

A. Object lines — Used to show main outline of structure, including exterior walls, interior partitions, porches, patios, sidewalks, parking lots, and driveways

(NOTE: Object lines are always the heaviest lines in the drawing.)

B. Dimension line — Used to designate object and area dimensions

(NOTE: Dimension lines may end in arrows, dots, or slashes. The dimension is usually written above the dimension line.)

C. Extension lines — Used as parameters for dimension lines

D. Hidden line — Used to show lines that are not visible from view depicted

E. Center line — Used to designate center and to provide a reference point for dimensioning

F. Cutting plane (section line) — Used to indicate an area that has been cut away and shown in a section view; arrows indicate direction from which section drawing is to be viewed

G. Phantom line — Used to indicate alternative positions of moving parts, adjacent positions of related parts, and for repeated details

H. Break line — Used to show that an object or area has not been drawn in its entirety

I. Leader line — Used to connect a note or dimension to a related part of the drawing

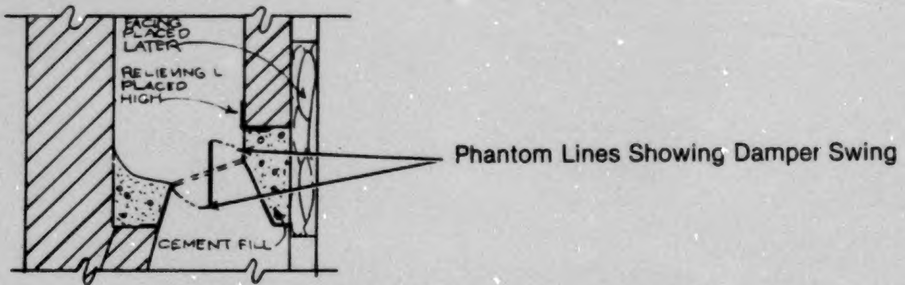
(NOTE: Leader lines are sometimes curved to avoid confusion with dimension lines and other lines.)

INFORMATION SHEET

V. Lines in the alphabet of lines (Figures 8 and 9)

A. Phantom line

FIGURE 8


FACING PLACED LATER
RELIEVING L PLACED HIGH
CEMENT FILL
Phantom Lines Showing Damper Swing

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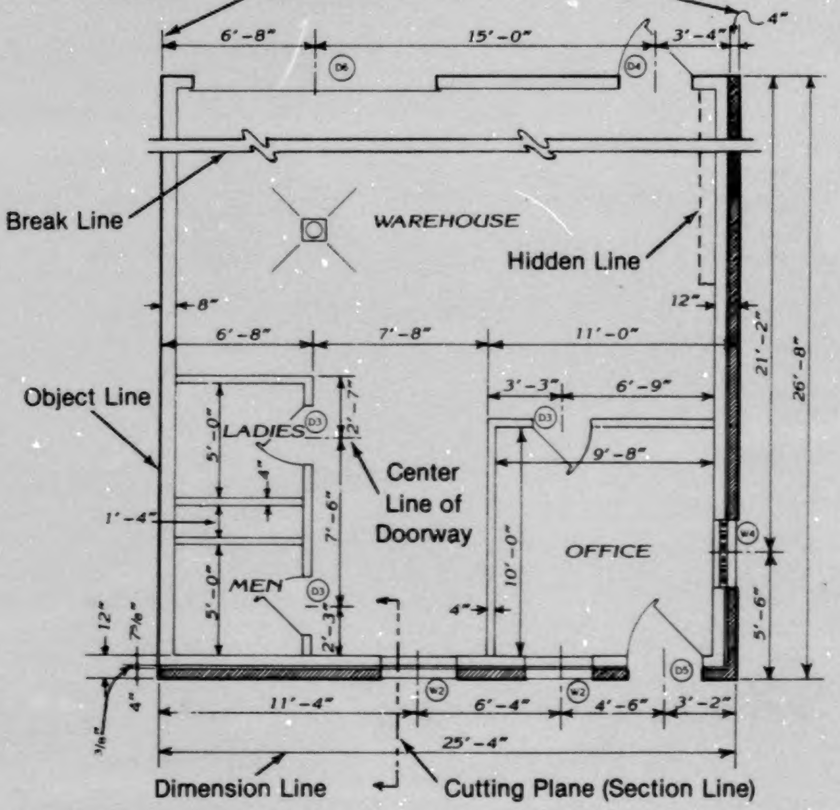
B. Other lines

FIGURE 9

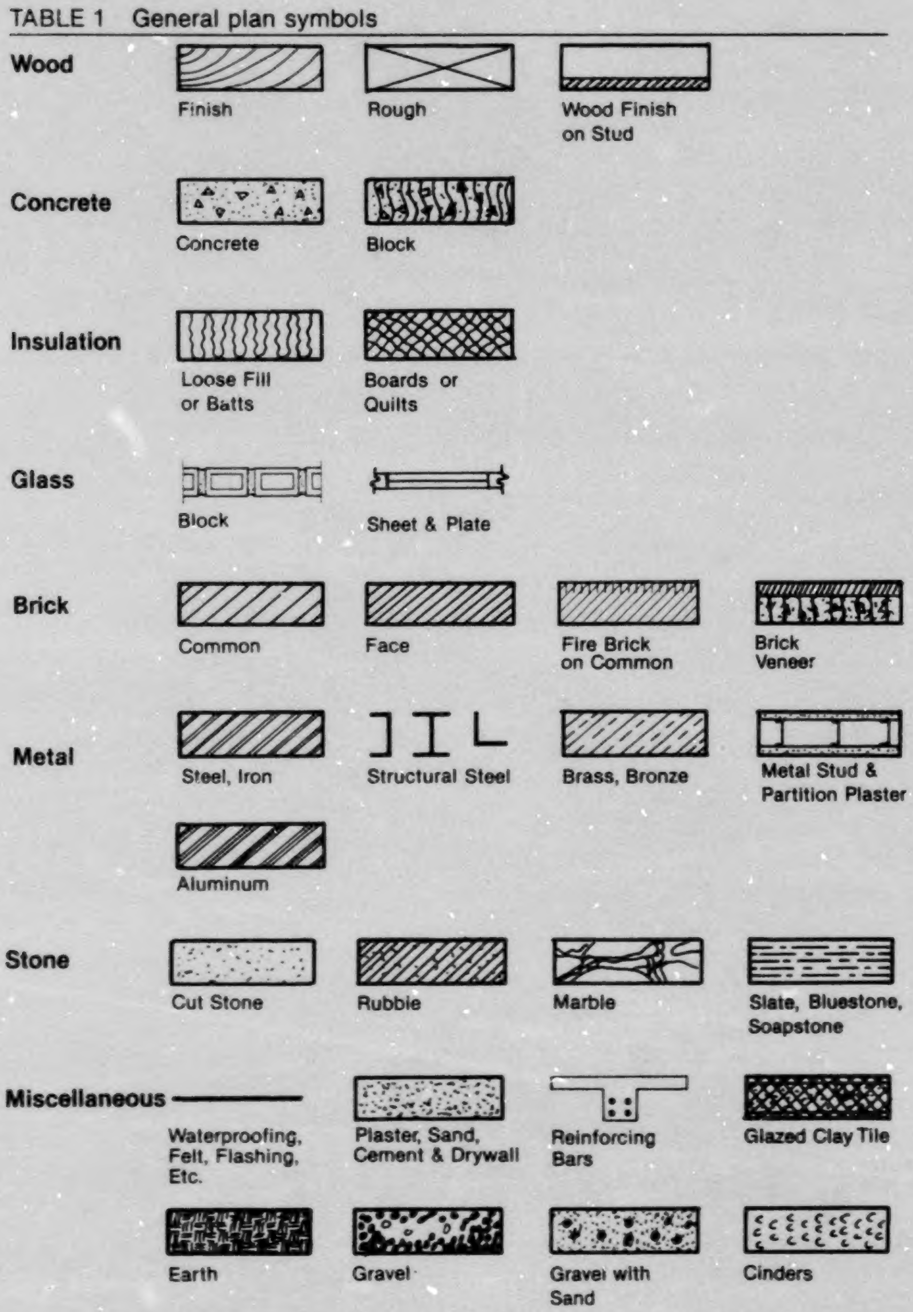

Extension Line
Leader Line
4"
6'-8"
15'-0"
3'-4"
D6
D4
Break Line
WAREHOUSE
Hidden Line
8"
12"
6'-8"
7'-8"
11'-0"
21'-2"
26'-8"
Object Line
3'-3"
6'-9"
D3
LADIES
5'-0"
2'-7"
9'-8"
4"
Center Line of Doorway
1'-4"
7'-6"
10'-0"
OFFICE
W4
MEN
D3
5'-0"
2'-3"
4"
12"
7/16"
5'-6"
D5
W2
W2
4"
3/16"
11'-4"
6'-4"
4'-6"
3'-2"
25'-4"
Dimension Line
Cutting Plane (Section Line)

INFORMATION SHEET

VI. Materials symbols commonly used on plans

A. General plan symbols (Table 1)

TABLE 1 General plan symbols

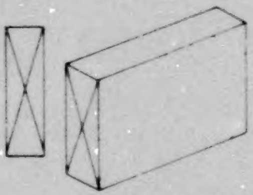

Wood
Finish
Rough
Wood Finish on Stud
Concrete
Concrete
Block
Insulation
Loose Fill or Batts
Boards or Quilts
Glass
Block
Sheet & Plate
Brick
Common
Face
Fire Brick on Common
Brick Veneer
Metal
Steel, Iron
Structural Steel
Brass, Bronze
Metal Stud & Partition Plaster
Aluminum
Stone
Cut Stone
Rubble
Marble
Slate, Bluestone, Soapstone
Miscellaneous
Waterproofing, Felt, Flashing, Etc.
Plaster, Sand, Cement & Drywall
Reinforcing Bars
Glazed Clay Tile
Earth
Gravel
Gravel with Sand
Cinders

INFORMATION SHEET

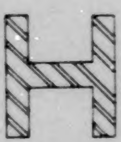
B. Section view symbols (Table 2)

TABLE 2 Section view symbols

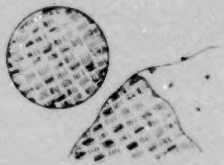
Rough lumber



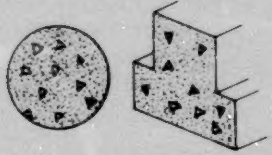
Metal



Earth

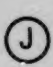
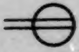
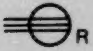
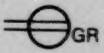
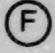
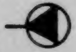
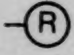
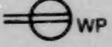
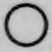
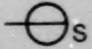
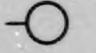
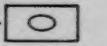


Concrete



VII. Electrical symbols commonly used on plans (Table 3)

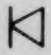
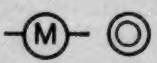
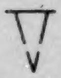
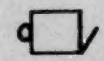
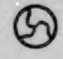
TABLE 3 Common electrical symbols

General outlets		Receptacle outlets	
Junction box, ceiling		Duplex receptacle outlet	
Range outlet		Grounded outlet, duplex	
Fan outlet, ceiling		Special-purpose receptacle outlet, single	
Recess incandescent, wall		Weatherproof outlet, duplex	
Surface incandescent, ceiling		Switch and single receptacle	
Surface incandescent, wall			
Surface or pendant single fluorescent fixture			

(NOTE: Subscript letters with the symbol indicate functions, such as "DW" for dishwasher or "DF" for drinking fountain.)

INFORMATION SHEET

TABLE 3 — *Continued*

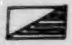
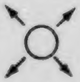
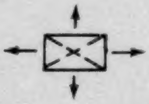
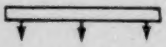
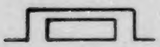
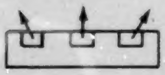
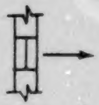
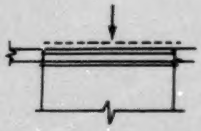
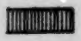
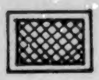
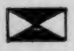
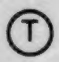
Switch outlets		Auxiliary systems	
Single-pole switch	S	Telephone jack	
Double-pole switch	S_2	Meter	
Three-way switch	S_3	Vacuum outlet	
Four-way switch	S_4	Electric door opener	$\boxed{\text{D}}$
Switch and pilot lamp	S_P	Chime	$\boxed{\text{CH}}$
Weatherproof switch	S_{WP}	Push button (doorbell)	⊡
Fused switch	S_F	Bell and buzzer combination	
Circuit breaker	S_{CB}	Kitchen ventilating fan	

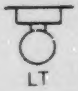
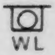
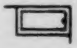
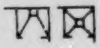
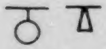
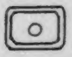
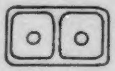
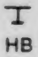
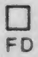
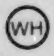
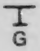
Panels and miscellaneous	
Lighting panel	■
Power panel	▨
Television outlet	$\boxed{\text{TV}}$

INFORMATION SHEET

VIII. Mechanical symbols commonly used on plans (Table 4)

TABLE 4 Mechanical symbols

Heating and air conditioning	
Exhaust, return, or outside air duct section	
Supply outlet, ceiling diffuser	 
Linear diffuser	
Recessed radiator	
Unit heater	
Louver opening	
Intake louvers on screen	
Floor register	
Wall or space heater	
Supply duct section	
Thermostat	

Plumbing	
Water closet (low tank)	
Wall lavatory	
Corner bath	
Shower stall	
Shower head	
Residential sink (single)	
Residential sink (double)	
Hose bibb	
Floor drain	
Water heater	
Gas outlet	

(NOTE: Letters with the symbol indicate functions, such as LT for low tank.)

INFORMATION SHEET

IX. Abbreviations commonly used on plans

(NOTE: Many of the following abbreviations may also appear on written specifications; however, there is less standardization on specifications, and the abbreviations may contain periods and be written in lowercase letters.)

Anchor bolt	**AB**
Angle	∠
Architectural	**ARCH**
Bathroom	**B**
Bearing plate	**BRG PL**
Bench mark	**BM** or ⊕
Block	**BLK**
Blocking	**BLKG**
Bookshelf	**BKSH**
Brick	**BRK**
Building line	**BL**
Cabinet	**CAB**
Center	**CTR**
Center line	**CL** or ℄
Center to center	**CC** or **C** to **C**
Clean-out door	**COD**
Closet	**C, CL, CLO**
Column	**COL**
Concrete block	**CONC B**
Counter	**CTR**
Cut out	**CO**
Detail	**DET**
Dimension	**DIM**
Dining room	**DR**
Dishwasher	**DW**
Disposal	**DISP**
Double hung	**DH**
Double-strength glass	**DSG**
Downspout	**DS**
Dressed and matched	**D & M**
Elevation	**ELEV**
Entry	**ENT**
Exhaust	**EXH**
Expansion joint	**EXP JT**
Finish floor	**FIN FL**
Finish grade	**FG**
Firebrick	**FBRK**
Fireplace	**FP**
Flashing	**FL**
Foundation	**FDN**
Full size	**FS**
Furring	**FUR**
Gas	**G**
Glass block	**GL BL**
Grade	**GR**
Grade line	**GL**
Hardware	**HDW**
Hollow metal door	**HMD**
Hose bibb	**HB**
Inside diameter	**ID**
Insulation	**INS**
Jamb	**JB**

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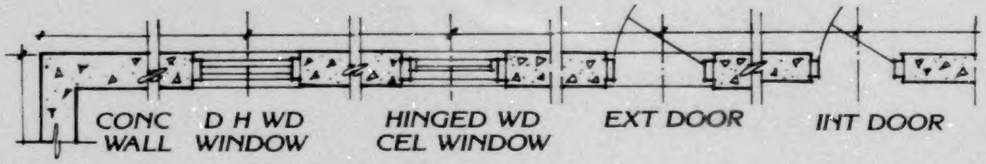
Joint	**JT**
Joist	**JST**
Kitchen	**K**
Lavatory	**LAV**
Lineal	**LIN**
Living room	**LR**
Masonry opening	**MO**
Material	**MATL**
Metal clad	**MC**
Natural grade	**NG**
Nosing	**NOS**
Not to scale	**NTS**
On center	**OC**
Opening	**OPNG**
Overhead	**OVH**
Partition	**PTN**
Plaster	**PL or PLAS**
Plate	**PL**
Plywood	**PLYWD**
Precast	**PRCST**
Radius	**R**
Recessed	**REC**
Reinforced	**REINF**
Required	**REQD**
Riser	**R**
Rough opening	**RO**
Scale	**SC**
Sheathing	**SHTHG**
Single-strength glass	**SSG**
Soil pipe	**SP**
Specifications	**SPEC**
Standard	**STD**
Steel	**ST or STL**
Stone	**ST**
Structural	**STR**
Terra cotta	**TC**
Typical	**TYP**
Utility room	**U RM or UR**
Vanity	**VAN**
Waterproofing	**WP**
Weep hole	**WH**
Wire mesh	**WM**
Wood	**WD**
Wood frame	**WF**

X. Representations of conventions used by architects (Figures 10-16)

A. Doors and windows in concrete wall

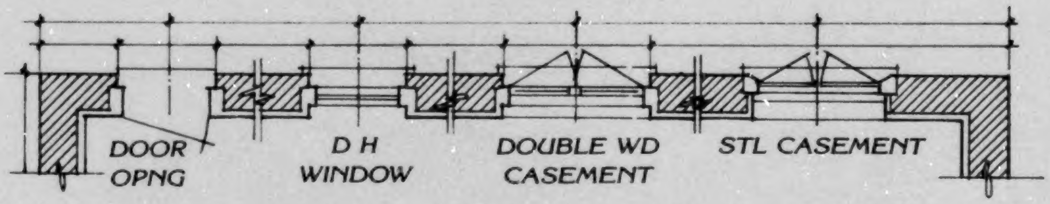
FIGURE 10



INFORMATION SHEET

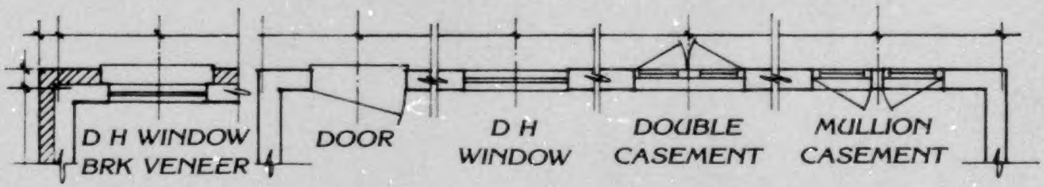
B. Doors and windows in solid brick wall

FIGURE 11


DOOR
OPNG
D H
WINDOW
DOUBLE WD
CASEMENT
STL CASEMENT

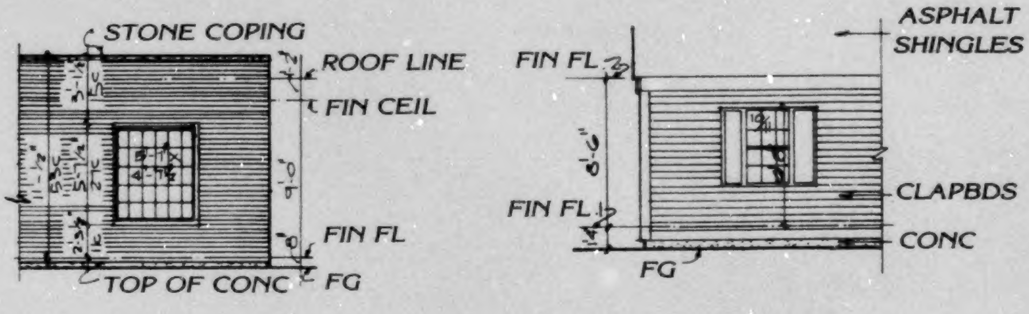
C. Doors and windows in brick veneer and wood stud walls

FIGURE 12


D H WINDOW
BRK VENEER
DOOR
D H
WINDOW
DOUBLE
CASEMENT
MULLION
CASEMENT

D. Window elevations

FIGURE 13


STONE COPING
ROOF LINE
FIN CEIL
9'-0"
FIN FL
TOP OF CONC
FG
ASPHALT
SHINGLES
FIN FL
8'-6"
FIN FL
CLAPBDS
CONC
FG

BRK WALL

WD WALL

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E. Dimensioning exterior and interior walls

FIGURE 14

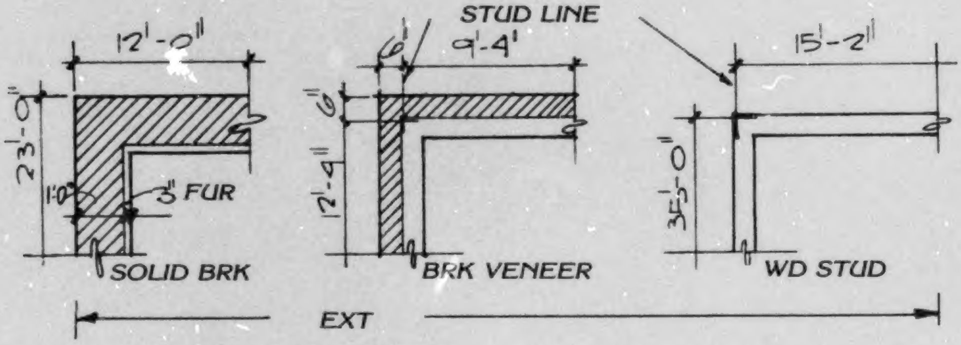
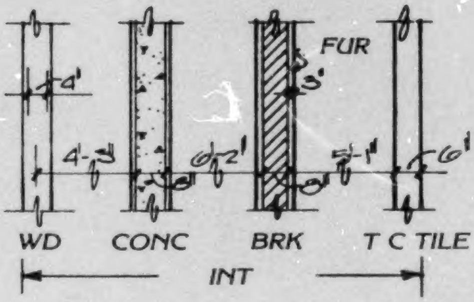
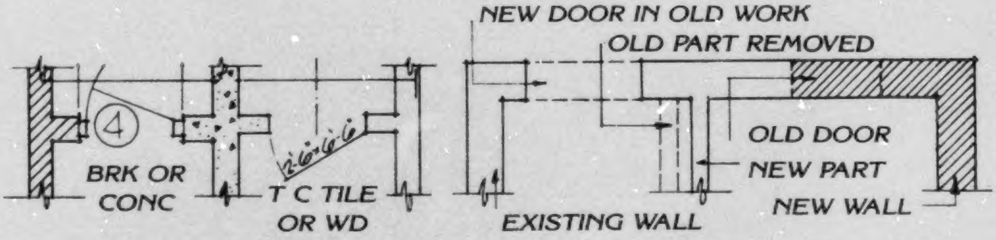

12'-0"
23'-0"
1'-0"
3" FUR
SOLID BRK
STUD LINE
6"
9'-4"
6"
12'-4"
BRK VENEER
15'-2"
35'-0"
WD STUD
EXT

FIGURE 15


4"
4'-3"
FUR
3"
6'-2"
5'-1"
6"
WD
CONC
BRK
T C TILE
INT

F. Interior dimensions and alterations

FIGURE 16


4
BRK OR CONC
2'-6"+6'-6"
T C TILE OR WD
NEW DOOR IN OLD WORK
OLD PART REMOVED
OLD DOOR
NEW PART
NEW WALL
EXISTING WALL

INFORMATION SHEET

XI. Purposes of written specifications

(NOTE: Written specifications are equally as important as the drawings in a set of plans. They furnish what the drawings cannot, in that they give detailed and accurate written descriptions of work to be done, including quality and quantity of materials, methods of construction, standards of construction, and manner of conducting the work. See Assignment Sheet Supplement #2 at the end of the Information Sheet for materials specifications.)

A. Avoiding disputes among builders, architects, and owners by leaving no room for misinterpretation or misunderstanding

B. Facilitating the checking of materials and workmanship during time that building is being constructed

C. Enabling contractors to make bids based on total materials and labor required

D. Avoiding expensive omissions when estimating total costs

E. Avoiding conflicting opinions during construction and avoiding the added costs and delays that could result

XII. Basic information included in a set of written specifications

A. Contract

B. Synopsis

C. General requirements

D. Owner's name and address

E. Architect's name

F. Location of structure

G. Completion date

H. Contractor's bid form

I. Guarantees

J. Insurance requirements

K. Methods of construction

L. Types and quality of building materials

M. Sizes

INFORMATION SHEET

XIII. Using an architect's scale

A. Determine scale to be used

(NOTE: The scale used will be that to which the plan is drawn or one you have chosen if you are making a drawing.)

B. Locate the required scale on the architect's scale

EXAMPLES: 3/16", 1/4", 1"

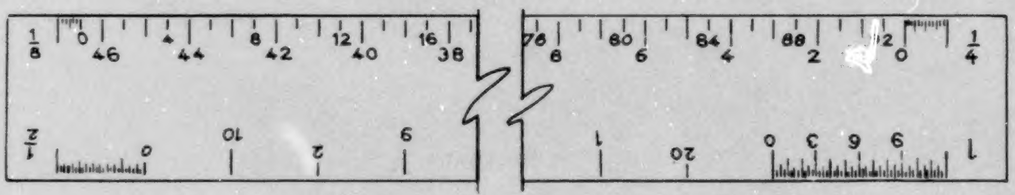
(NOTE: The whole or fractional number shown at the ends of an architect's scale shows the scales marked for that side. Thus, 3/16 designates a scale of 3/16" = 1' -0". The marks for a 3/16-inch scale are 3/16 of an inch apart, with each mark representing 1 foot of distance on the drawing.)

C. Determine direction in which required scale is read

(NOTE: Each scale is numbered, beginning near the number that designates the scale used, and is read toward the opposite end. For example, in Figure 17, the 1/8-inch scale begins at the left end and is read to the right. The 1/4-inch scale begins at the right end and is read to the left.)

EXAMPLE:

FIGURE 17



D. Locate the zero mark for the required scale

(NOTE: The distance between the zero mark and the scale designation is subdivided to show inches or fractions of inches at that scale. Foot designations are aligned with the zero mark.)

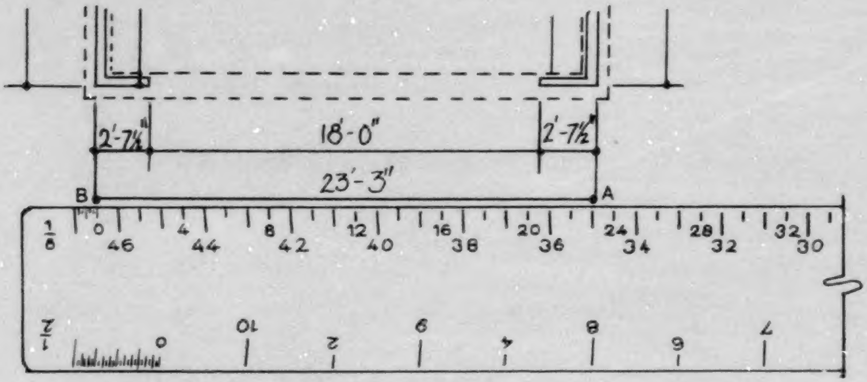
E. Measure the distance on the plan

EXAMPLE: Measure the width of the garage door opening in Figure 18, using a scale of 1/8" = 1' -0".

INFORMATION SHEET

1. Align the largest possible foot mark with one reference point, with other reference point falling within the scale's inch subdivisions (Figure 18)

FIGURE 18

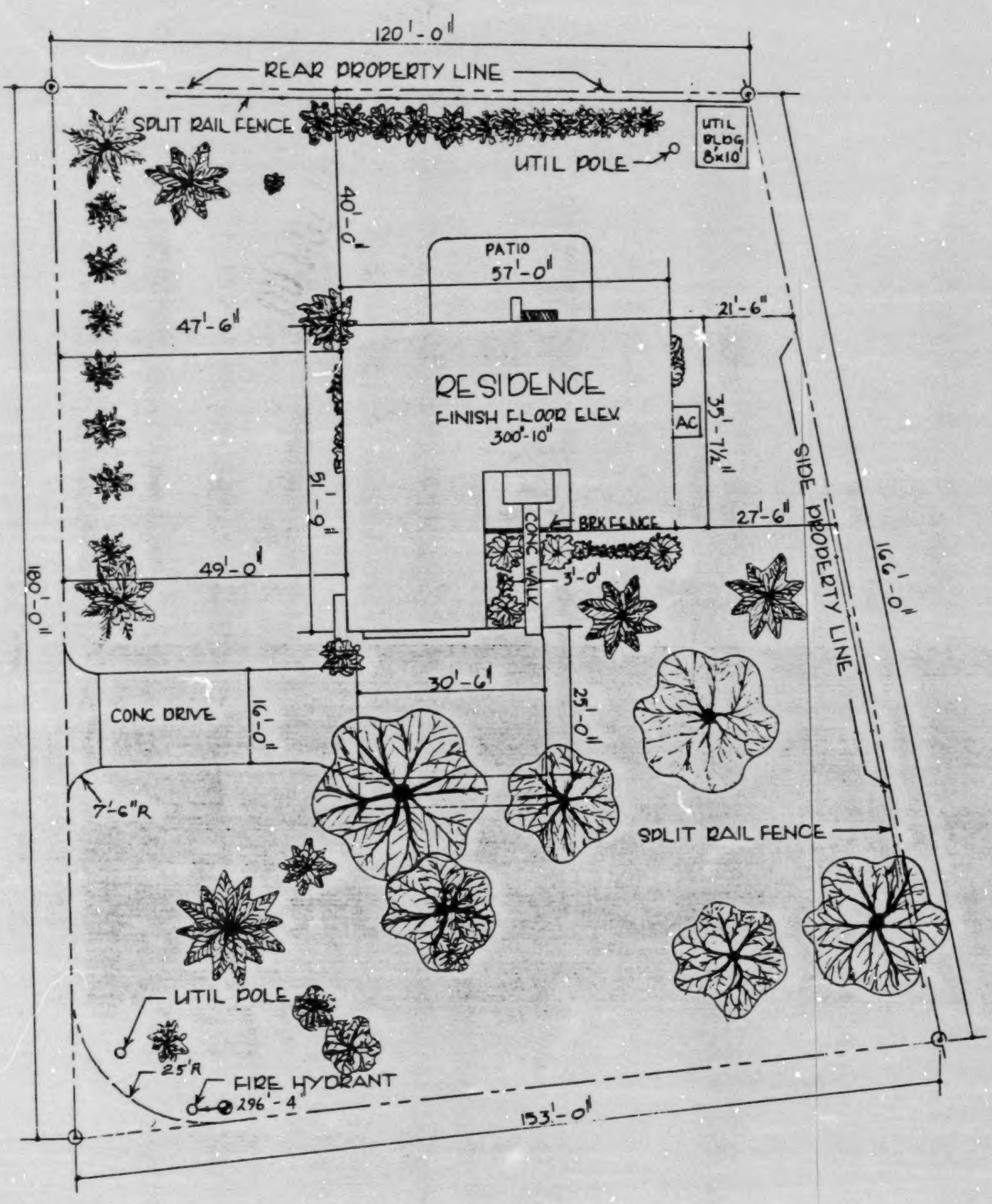

2'-7½"
18'-0"
2'-7½"
23'-3"
B
A
1/8
0 4 8 12 16 20 24 28 32
46 44 42 40 38 36 34 32 30
1/2
0 10 2 6 4 8 6 7

2. Note the value of the foot mark
3. Add to the foot value the value of the inch subdivisions

EXAMPLE: The distance measured in Figure 18 is 23' - 1" because the distance from the zero mark to Point A is 23 feet, and the distance from the zero mark to Point B is 1 inch.

ASSIGNMENT SHEET SUPPLEMENT #1

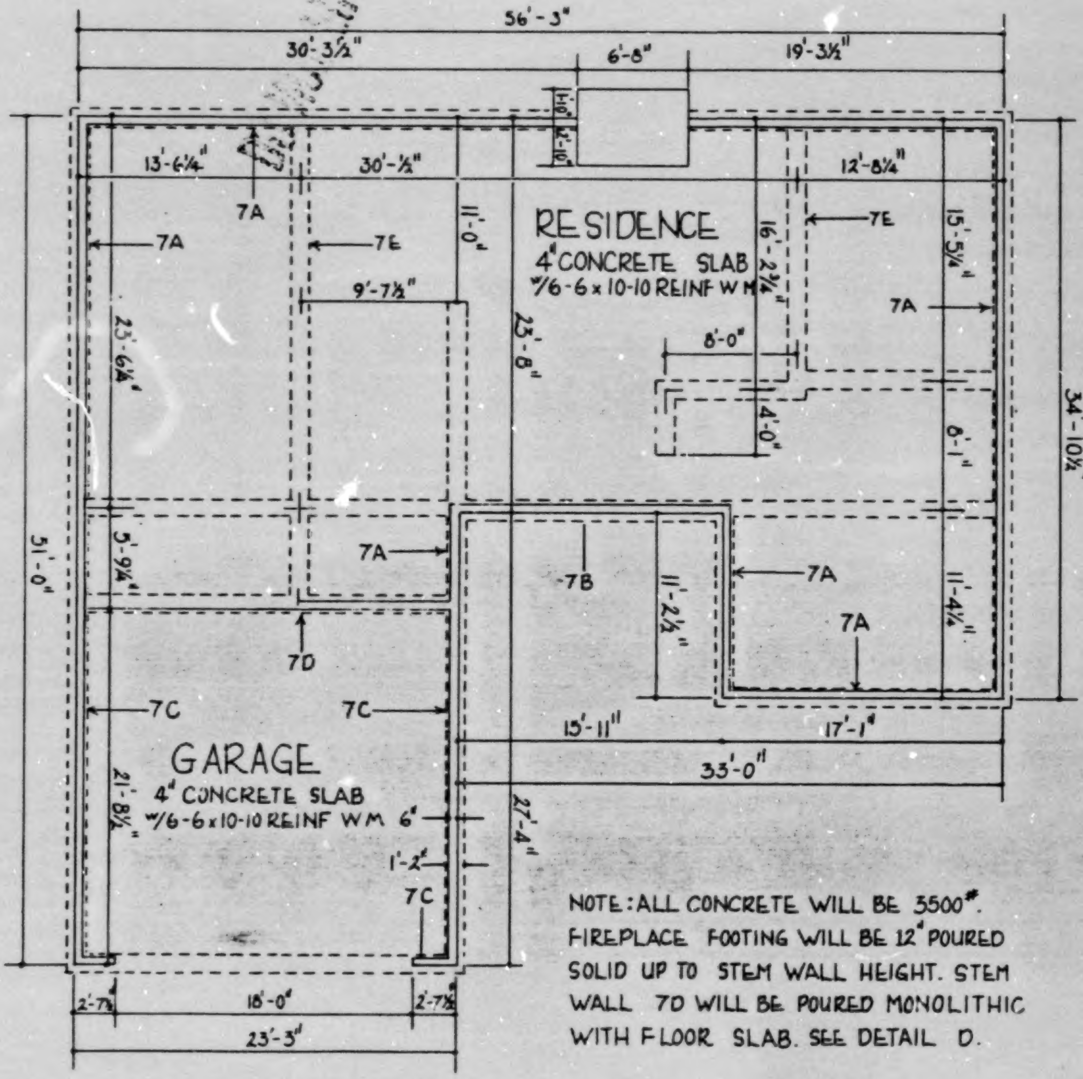
FC - 277-B


120'-0"
REAR PROPERTY LINE
SPLIT RAIL FENCE
UTIL BLDG 8'x10'
UTIL POLE
40'-0"
PATIO
57'-0"
47'-6"
21'-6"
RESIDENCE
FINISH FLOOR ELEV. 300'-10"
AC
35'-7½"
51'-9"
BRK FENCE
CONC WALK
27'-6"
SIDE PROPERTY LINE
166'-0"
49'-0"
3'-0"
180'-0"
30'-6"
25'-0"
CONC DRIVE
16'-0"
7'-6"R
SPLIT RAIL FENCE
UTIL POLE
25'R
FIRE HYDRANT
296'-4"
153'-0"

PLOT PLAN

SCALE:- 1" = 20'-0"

N


56'-3"
30'-3½"
6'-8"
19'-3½"
1'-10"
2'-10"
13'-6¼"
30'-½"
12'-8¼"
7A
7A
7E
7E
11'-0"
RESIDENCE
4" CONCRETE SLAB
W/6-6x10-10 REINF WM
16'-2¾"
15'-5¼"
9'-7½"
7A
23'-6¼"
23'-8"
8'-0"
34'-10½"
4'-0"
6'-1"
51'-0"
5'-9¼"
7A
7B
11'-2½"
7A
11'-4¼"
7A
7D
7C
7C
15'-11"
17'-1"
33'-0"
GARAGE
4" CONCRETE SLAB
W/6-6x10-10 REINF WM 6"
21'-8½"
27'-4"
1'-2"
7C
2'-7½"
18'-0"
2'-7½"
23'-3"

NOTE: ALL CONCRETE WILL BE 3500#. FIREPLACE FOOTING WILL BE 12" POURED SOLID UP TO STEM WALL HEIGHT. STEM WALL 7D WILL BE POURED MONOLITHIC WITH FLOOR SLAB. SEE DETAIL D.

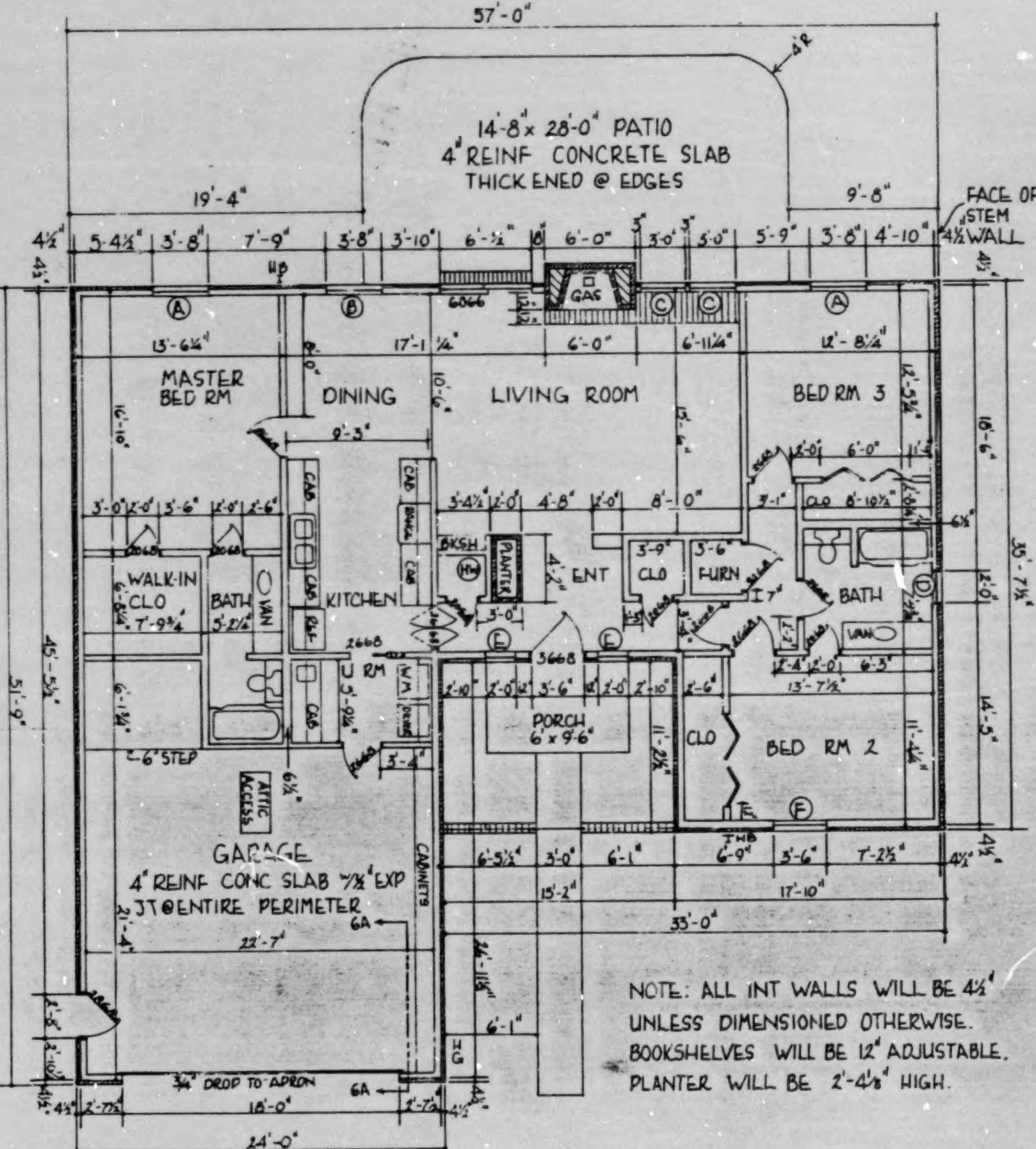
FOUNDATION PLAN

SCALE :- 1/8" = 1'-0"

N

ASSIGNMENT SHEET SUPPLEMENT #1

FC - 281-B


57'-0"
14'-8" x 28'-0" PATIO
4" REINF CONCRETE SLAB
THICKENED @ EDGES
19'-4"
9'-8"
FACE OF STEM WALL
4½" WALL
MASTER BED RM
DINING
LIVING ROOM
BED RM 3
KITCHEN
ENT
CLO
FURN
BATH
WALK-IN CLO
VAN
PLANTER
BKSH
HW
U RM
W/A
DRYER
CAB
R/F
PORCH 6' x 9'-6"
CLO
BED RM 2
GARAGE
4" REINF CONC SLAB ½" EXP JT @ ENTIRE PERIMETER
ATTIC ACCESS
2'-6" STEP
CABINETS
6066
3668
2668
GAS
¾" DROP TO APRON
6A
33'-0"
24'-0"
18'-0"
22'-7"
51'-9"
45'-5½"
35'-7½"
16'-6"
14'-5"
15'-2"
17'-10"

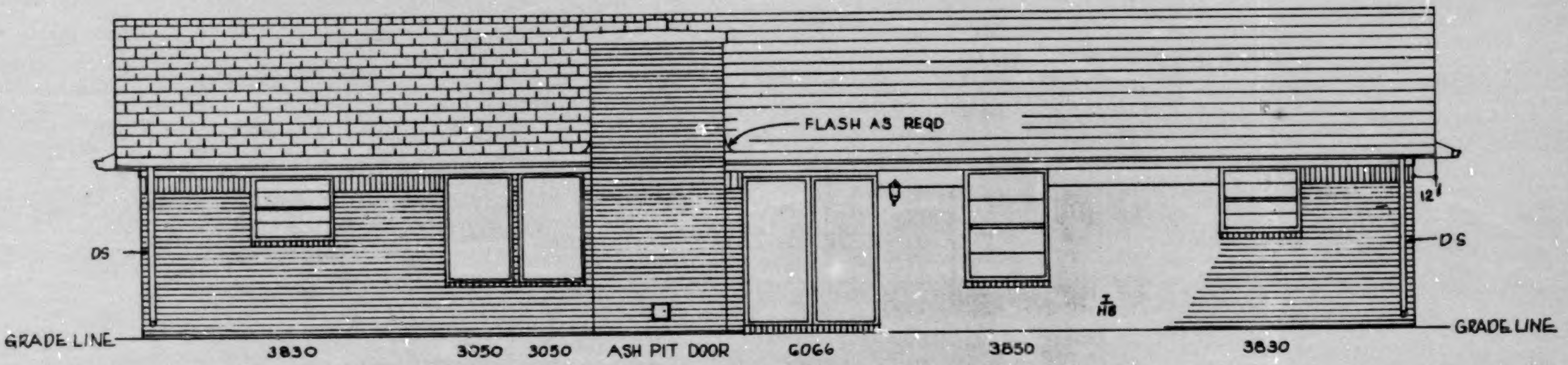
NOTE: ALL INT WALLS WILL BE 4½" UNLESS DIMENSIONED OTHERWISE.
BOOKSHELVES WILL BE 12" ADJUSTABLE.
PLANTER WILL BE 2'-4⅛" HIGH.

FLOOR PLAN

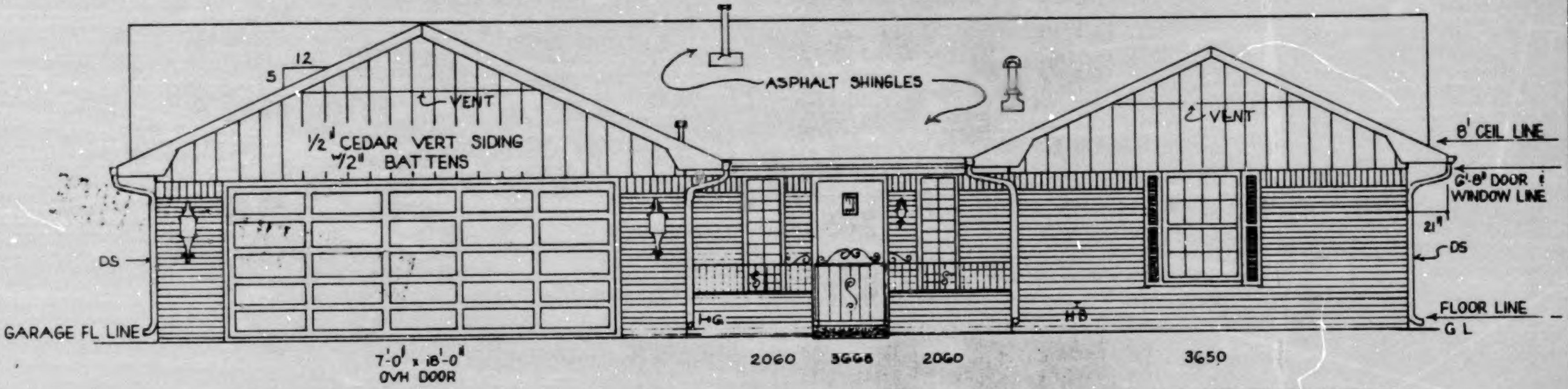
SCALE :- ⅛" = 1'-0"

SHEET 3

ASSIGNMENT SHEET SUPPLEMENT #1


FLASH AS REQD
DS
DS
12"
GRADE LINE
GRADE LINE
HB
3830
3050
3050
ASH PIT DOOR
6066
3850
3830

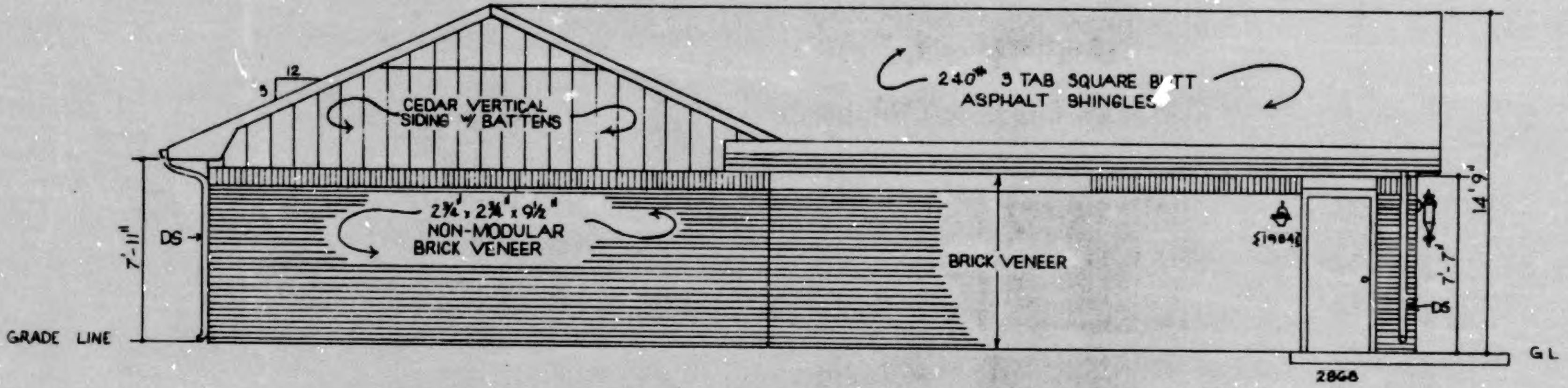
EAST ELEVATION


12
5
VENT
1/2" CEDAR VERT SIDING
W/2" BATTENS
ASPHALT SHINGLES
VENT
8' CEIL LINE
6'-8" DOOR & WINDOW LINE
21"
DS
DS
FLOOR LINE
G L
GARAGE FL LINE
HB
HB
7'-0" x 18'-0"
OVH DOOR
2060
3668
2060
3650

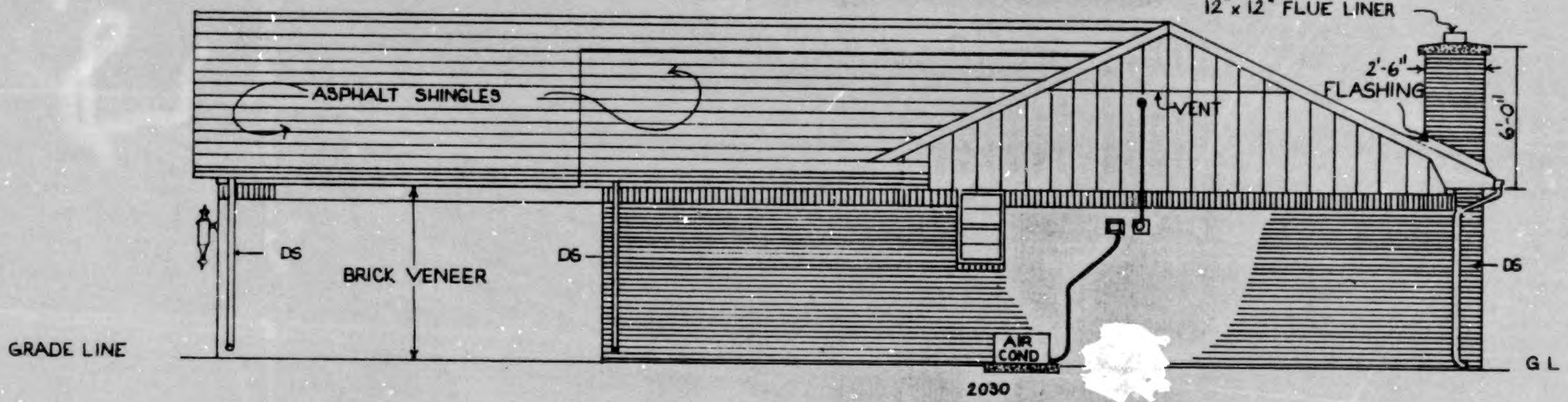
ELEVATION PLAN

WEST ELEVATION

SCALE :-3/16"=1'-0"


12
5
CEDAR VERTICAL SIDING W/ BATTENS
240# 3 TAB SQUARE BUTT ASPHALT SHINGLES
2¾" x 2¾" x 9½" NON-MODULAR BRICK VENEER
7'-11"
DS
GRADE LINE
BRICK VENEER
1904
14'-9"
7'-7"
DS
GL
2868

NORTH ELEVATION

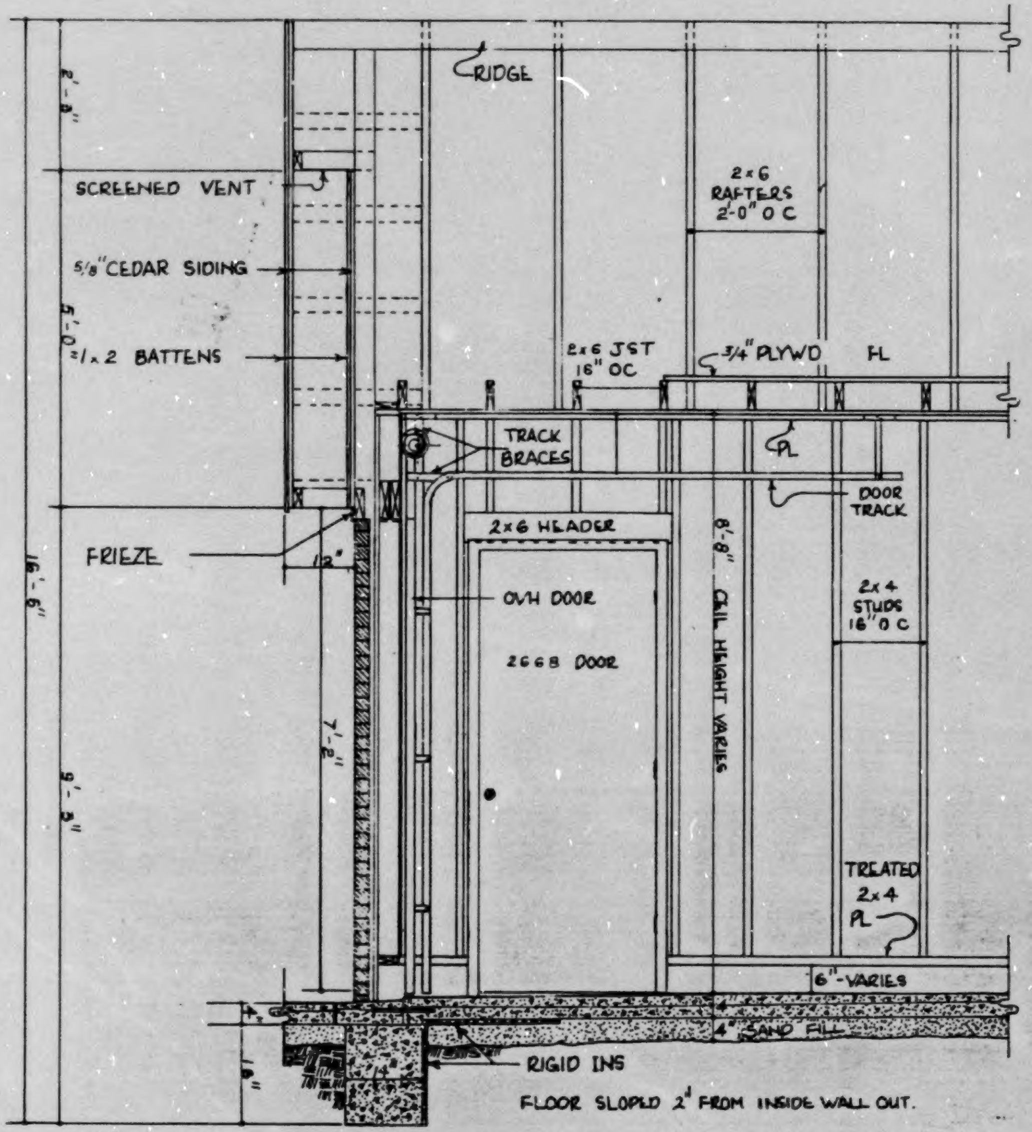

12" x 12" FLUE LINER
ASPHALT SHINGLES
2'-6"
FLASHING
6'-0"
VENT
DS
BRICK VENEER
DS
DS
GRADE LINE
AIR COND
2030
GL

ELEVATION PLAN

CONTINUED

SOUTH ELEVATION

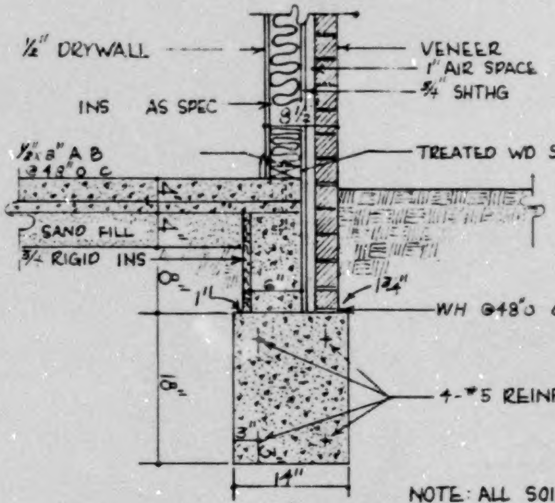
SCALE :- 3/16" = 1'-0"


RIDGE
2'-8"
SCREENED VENT
2x6 RAFTERS 2'-0" O C
5/8" CEDAR SIDING
5'-0"
1x2 BATTENS
2x6 JST 16" OC
3/4" PLYWD
FL
TRACK BRACES
PL
DOOR TRACK
2x6 HEADER
8'-8" CEIL HEIGHT VARIES
FRIEZE
1/2"
16'-6"
OVH DOOR
2668 DOOR
2x4 STUDS 16" O C
7'-2"
9'-3"
TREATED 2x4 PL
6"-VARIES
4"
4" SAND FILL
16"
RIGID INS
FLOOR SLOPED 2" FROM INSIDE WALL OUT.

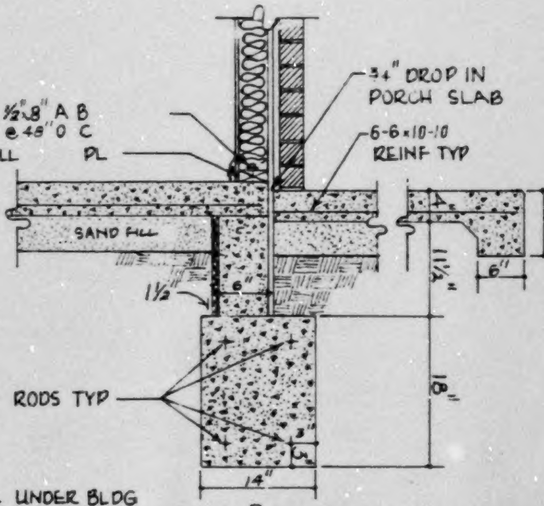
SECTION AA

SECTION DRAWING

SCALE :- 1/2" = 1'-0"

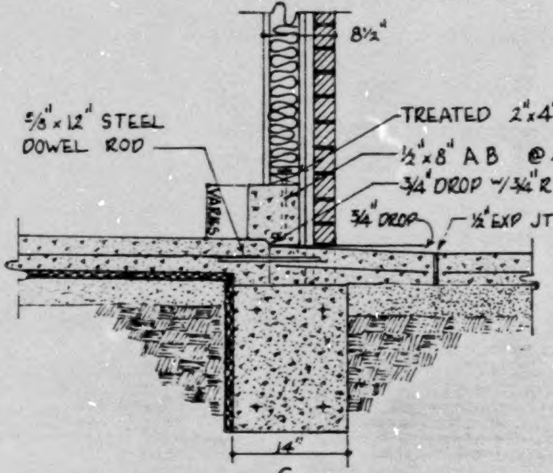

½" DRYWALL
INS AS SPEC
½"x 8" A B @ 48" O C
SAND FILL
¾ RIGID INS
VENEER
1" AIR SPACE
¾" SHTHG
8½
TREATED WD SILL
WH @ 48" O C
1¾"
1"
8"
6"
4"
18"
3"
14"
4-#5 REINF RODS TYP

A

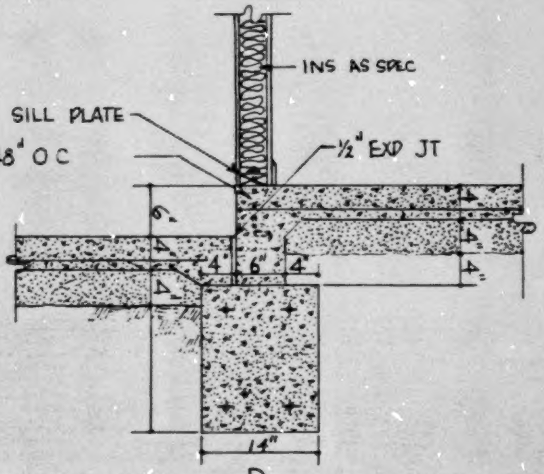

¾" DROP IN PORCH SLAB
½"x 8" A B @ 48" O C
PL
6-6 x 10-10 REINF TYP
SAND FILL
1½"
6"
8"
11½"
6"
18"
3"
14"

B

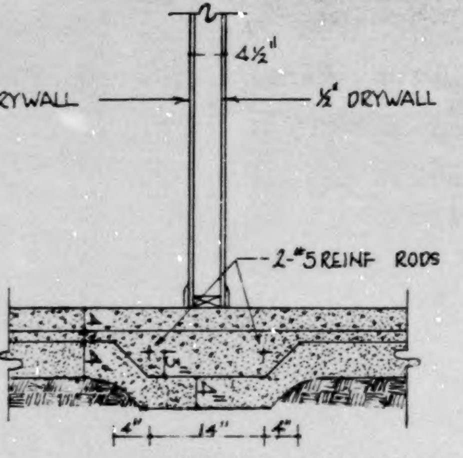
NOTE: ALL SOIL UNDER BLDG TO BE TREATED FOR TERMITE PROTECTION.


8½"
⅝"x 12" STEEL DOWEL ROD
TREATED 2"x 4" SILL PLATE
½"x 8" A B @ 48" O C
¾" DROP w/ ¾" R
¾" DROP
½" EXP JT
VARIES
14"

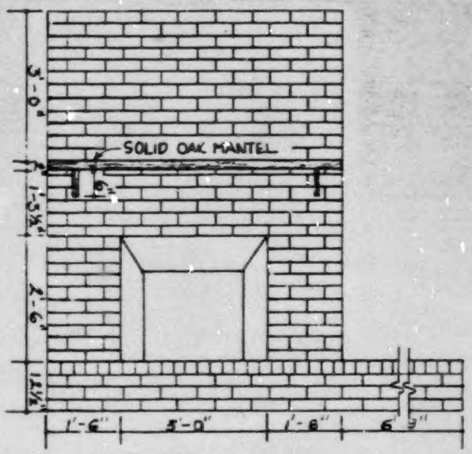
C


INS AS SPEC
½" EXP JT
6"
4"
4"
6"
4"
4"
4"
4"
14"

D


4½"
½" DRYWALL
½" DRYWALL
2-#5 REINF RODS
4"
4"
4"
4"
14"
4"

E FOUNDATIONS

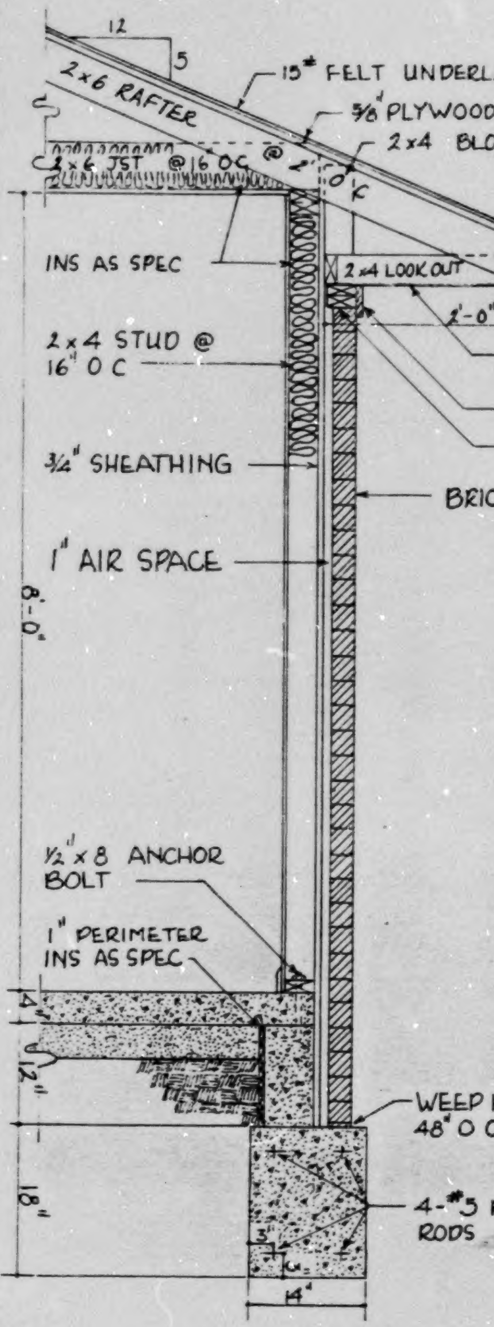

3'-0"
SOLID OAK MANTEL
6"
1'-3½"
2'-6"
12½"
1'-6"
3'-0"
1'-6"
6'-3"

FIREPLACE

SCALE :- ¾" = 1'-0"

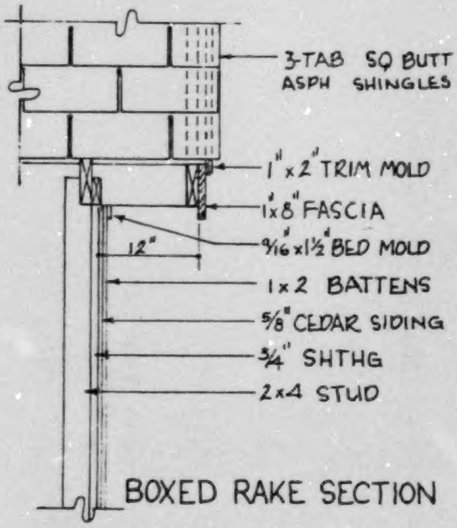
SCALE :- ⅜" = 1'-0"

DETAILS

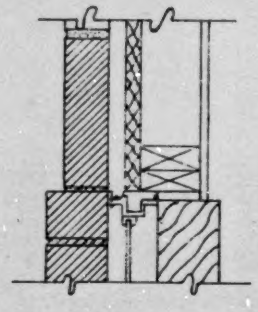

12
5
2x6 RAFTER
15# FELT UNDERLAYMENT
5/8" PLYWOOD SHTHG
2x4 BLOCKING
2x6 JST @16 OC
@ 2'-0" OC
INS AS SPEC
2x4 LOOKOUT
1"x2" TRIM
1"x8" FASCIA
2'-0"
1/4" EXT PLYWOOD SOFFIT
1"x4" FRIEZE
2x4 BLKG
2x4 STUD @ 16" O C
3/4" SHEATHING
BRICK VENEER
1" AIR SPACE
8'-0"
1/2"x8 ANCHOR BOLT
1" PERIMETER INS AS SPEC
4"
12"
18"
WEEP HOLE @ 48" O C
4-#5 REINF RODS
3"
14"

CORNICE CONST

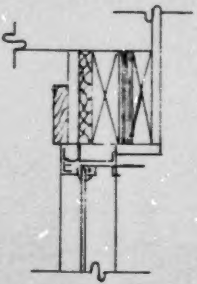
SCALE :- 3/4" = 1'-0"


3-TAB SQ BUTT ASPH SHINGLES
1"x2" TRIM MOLD
1"x8" FASCIA
9/16"x1½" BED MOLD
12"
1x2 BATTENS
5/8" CEDAR SIDING
3/4" SHTHG
2x4 STUD

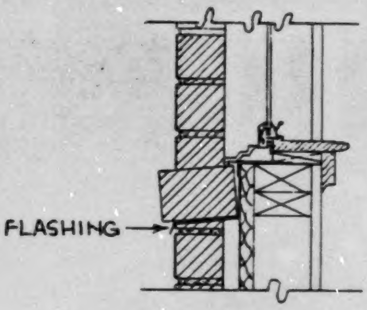
BOXED RAKE SECTION



JAMB



HEAD

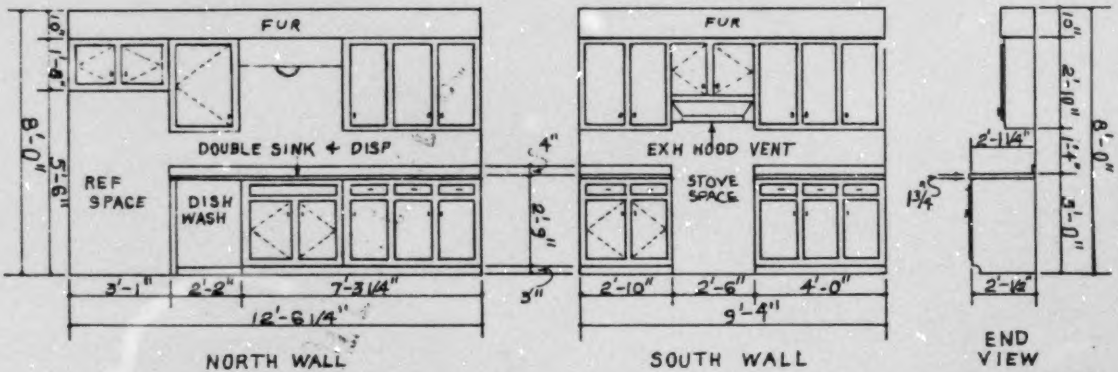


SILL

SCALE :- 1½" = 1'-0"

DETAILS

KITCHEN CABINETS

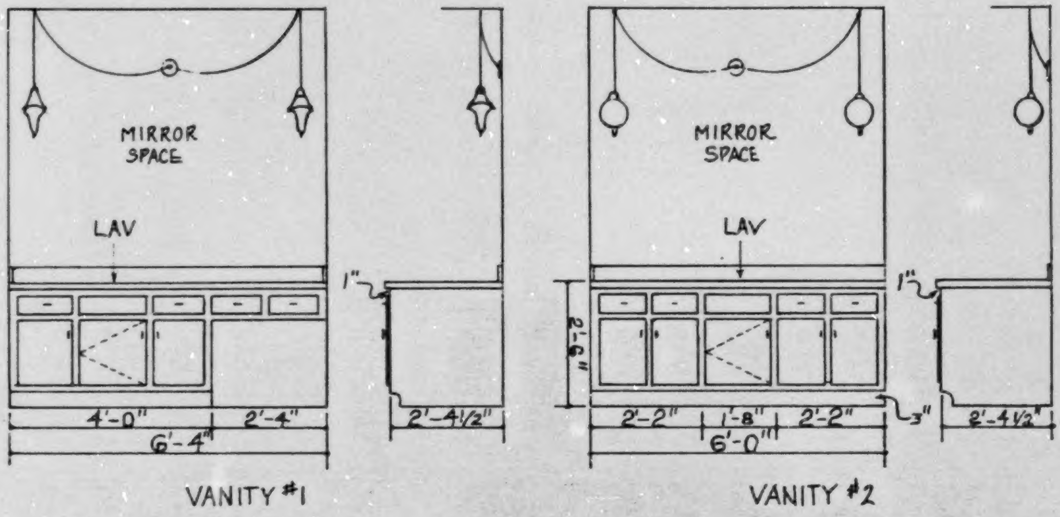

FUR
DOUBLE SINK + DISP
REF SPACE
DISH WASH
8'-0"
1'-4"
10"
5'-6"
2'-9"
4"
3"
3'-1"
2'-2"
7'-3 1/4"
12'-6 1/4"
NORTH WALL
FUR
EXH HOOD VENT
STOVE SPACE
2'-10"
2'-6"
4'-0"
9'-4"
SOUTH WALL
10"
2'-10"
1'-4"
3'-0"
8'-0"
2'-1 1/4"
1 3/4
2'-1/2"
END VIEW

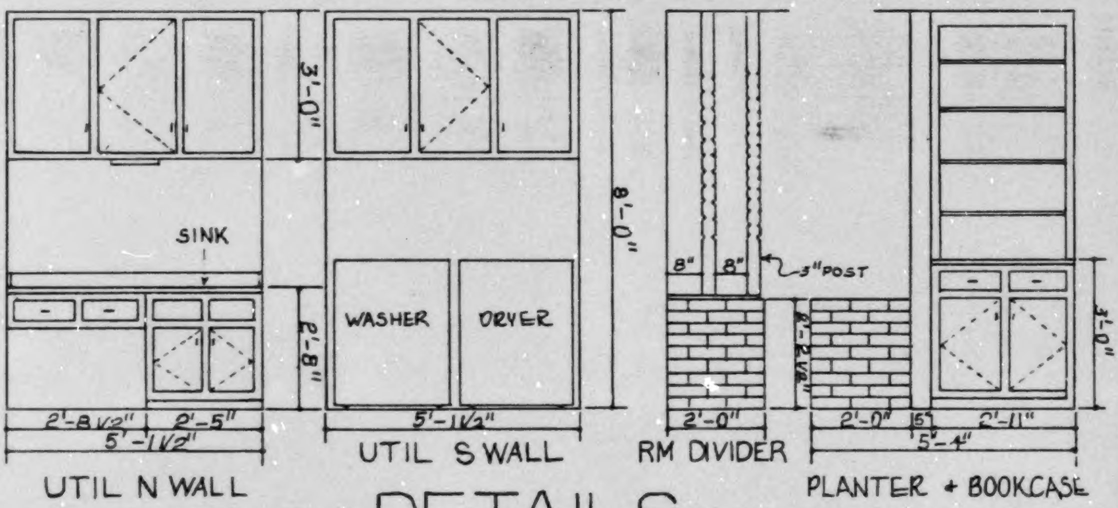
SCALE:-1/4"=1'-0"

ASSIGNMENT SHEET SUPPLEMENT #1

FC-283-B

BATHROOMS

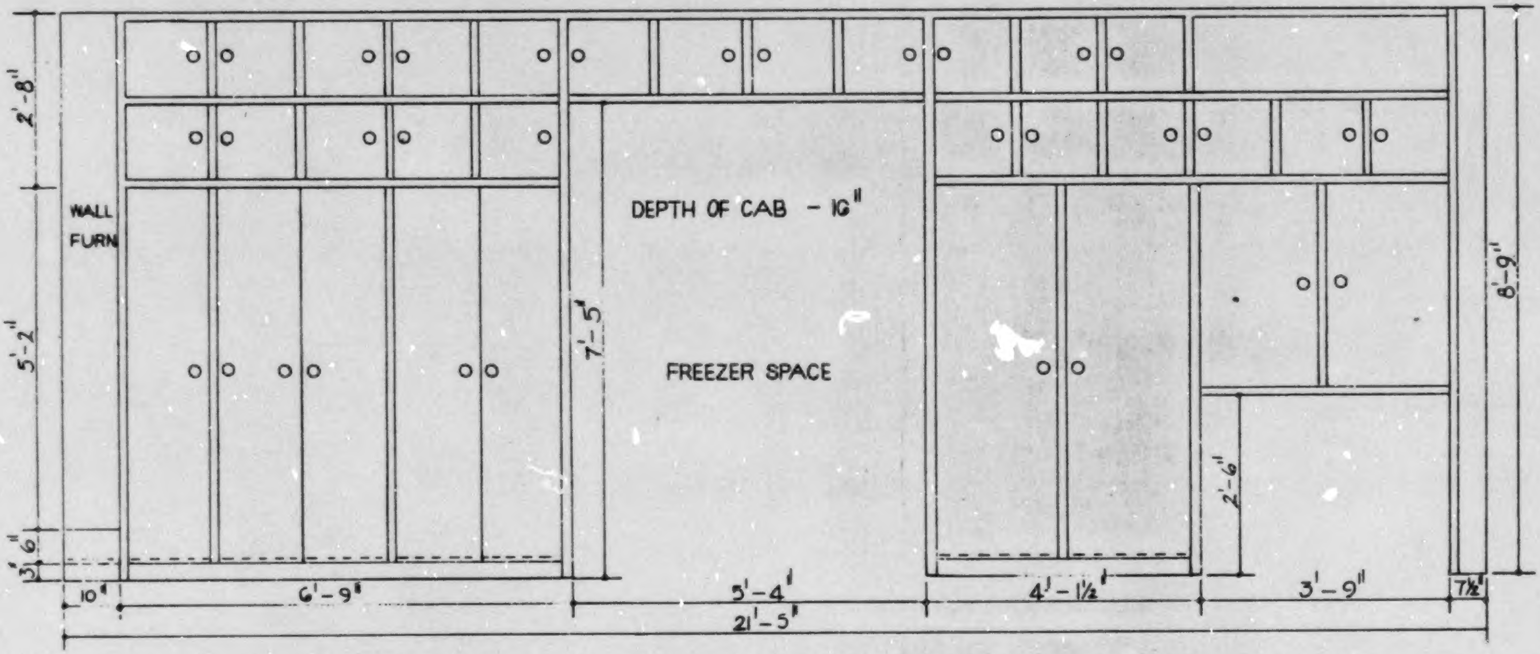

MIRROR SPACE
LAV
1"
4'-0"
2'-4"
6'-4"
2'-4 1/2"
VANITY #1
MIRROR SPACE
LAV
2'-6"
1"
2'-2"
1'-8"
2'-2"
6'-0"
3"
2'-4 1/2"
VANITY #2


3'-0"
SINK
2'-8"
2'-8 1/2"
2'-5"
5'-1 1/2"
UTIL N WALL
WASHER
DRYER
8'-0"
5'-1 1/2"
UTIL S WALL
8"
8"
3" POST
2'-2 1/2"
2'-0"
RM DIVIDER
2'-0"
5"
2'-11"
5'-4"
3'-0"
PLANTER + BOOKCASE

DETAILS

SCALE:-3/8"=1'-0"

ASSIGNMENT SHEET SUPPLEMENT #1


2'-8"
5'-2"
6"
3"
WALL FURN
DEPTH OF CAB - 16"
7'-5"
FREEZER SPACE
2'-6"
8'-9"
10"
6'-9"
5'-4"
4'-1½"
3'-9"
7½"
21'-5"

GARAGE CABINETS

DETAILS

SCALE :- ½" = 1'-0"

BEST COPY AVAILABLE

FINISH SCHEDULES

ROOM FINISHES

ROOMS	FLOOR					CEILING					WALL				BASE				TRIM				REMARKS
	CARPET	CERAMIC TILE	RUBBER TILE	CONCRETE		ACOUSTIC TEXT	DRYWALL	PAINT	CERAMIC TILE		DRYWALL	PAINT	WALL PAPER	CERAMIC TILE	WOOD	RUBBER	CERAMIC TILE	STAIN		WOOD	STAIN	PAINT	
ENTRY		✓				✓					✓	✓	✓		✓			✓		✓	✓		See owner for all painting
HALL	✓					✓					✓	✓			✓			✓		✓	✓		
BEDROOM 1	✓					✓					✓	✓	✓		✓			✓		✓	✓		See owner for grade of carpet
BEDROOM 2	✓					✓					✓	✓			✓			✓		✓	✓		See owner for grade of carpet
BEDROOM 3	✓					✓					✓	✓			✓			✓		✓	✓		See owner for grade of carpet
BATH 1	✓	✓				✓			✓		✓	✓	✓	✓	✓			✓		✓	✓		Wallpaper three walls around vanity
BATH 2		✓				✓			✓		✓	✓	✓	✓			✓			✓	✓		Water-seal tile Wallpaper w. wall
UTIL. + CLOSETS	✓		✓ ✓				✓	✓			✓ ✓	✓			✓			✓		✓ ✓	✓	✓	Use off-white flat/latex
KITCHEN			✓			✓					✓	✓				✓				✓	✓		
DINING	✓					✓					✓	✓	✓		✓			✓		✓	✓		
LIVING	✓					✓					✓	✓			✓			✓		✓	✓		see owner for carpet
GARAGE				✓			✓	✓						✓		✓				✓	✓		

DOOR SCHEDULE

DOOR	WIDTH	HEIGHT	THICKNESS	MATERIAL	TYPE	STORM DOOR	QUANTITY	THRESHOLD	REMARKS	MANUFACTURER
2068	2'-0"	6'-8"	1 3/8"	Wood-Ash	Hollow-core	No	5	None	oil stain	L.B.J. Door, Inc.
2468	2'-4"	6'-8"	1 3/8"	Wood-Ash	Hollow core	No	1	None	Oil stain	L.B.J. Door. Inc.
2668	2'-6"	6'-8"	1"	Wood-Ash	cafe	No	1pr.	None	Oil stain	L.B.J. Door. Inc.
2668	2'-6"	6'-8"	1 3/8"	Wood-Ash	Sliding-Pocket	No	1	None	Oil Stain	L.B.J. Door Inc.
2668	2'-[illegible]	6'-8"	1 3/8"	Wood-Ash	Hollow core	1 Screen	6	1 Alum.	Screen door in garage	L.B.J. Door Inc.
2868	2'-8"	6'-8"	1 3/4"	Metal Clad	Fireproof	Yes	1	Alum.	Paint	L.B.J. Door Inc.
3068	3'-0"	6'-8"	1 3/4"	Wood-Ash	Solid Core	No	1	None	Oil stain	L.B.J. Door Inc.
3668	3'-6"	6'-8"	1 3/4"	Wood-Ash	Solid Core	YES	1	Alum.	Marine Varnish	L.B.J. Door Inc.
6066	6'-0"	6'-6"	1/2"	Glass+Metal	Sliding	Yes	1pr.	Alum	Sliding screen	L.B.J. Door Inc.
6068	6'-0"	6'-8"	1 1/4"	Wood-Ash	Bi Fold	No	2 sets	None	Oil stain	L.B.J. Door Inc.
1956	1'-9"	5'-6"	1/2"	Glass & Metal	Sliding Shower door	No	2 sets	None	Frosted glass	L.B.J. Door Inc.

WINDOW SCHEDULE

SYMBOL	WIDTH	HEIGHT	MATERIAL	TYPE	SCREEN & STORM	QUANTITY	REMARKS	MANUFACTURER	CATALOG NUMBER
A	3'-8"	3'-0"	Aluminum	Double Hung	Yes	2	4 Lights 4 High	LBJ Window. Co.	141 PW
B	3'-8"	5'-0"	Aluminum	Double Hung	Yes	1	4 Lights 4 High	LBJ Window Co.	145 PW
C	3'-0"	5'-0"	Aluminum	Stationary	STORM ONLY	2	Single Lights	H&J Glass Co.	59 PY
D	2'-0"	3'-0"	Aluminum	Double Hung	Yes	1	4 lights 4 High	LBJ Window Co.	142 PW
E	2'-0"	6'-0"	Aluminum	Stationary	STORM ONLY	2	20 Lights	H&J Glass Co.	37 TS
F	3'-6"	5'-0"	Aluminum	Double Hung	Yes	1	16 lights 4 High	LBJ Window Co.	141 PW

HEADER SCHEDULE

HEADER SIZE	EXTERIOR		INTERIOR	
	26' + Under	26' to 32'	26' + Under	26' to 32'
2-2x4	3'-6"	3'-0"	Use 2-2x6	
2-2x6	6'-6"	6'-0"	4'-0"	3'-0"
2-2x8	8'-6"	8'-0"	5'-6"	5'-0"
2-2x10	11'-0"	10'-0"	7'-0"	6'-6"
2-2x12	13'-6"	12'-0"	8'-6"	8'-0"

SCHEDULES

ASSIGNMENT SHEET SUPPLEMENT #1

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FHA Form 2005
VA Form 26-1852
Rev. 2/75

U. S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
FEDERAL HOUSING ADMINISTRATION
For accurate register of carbon copies, form may be separated along above fold. Staple completed sheets together in original order.

Form Approved
OMB No. 63–R0055

DESCRIPTION OF MATERIALS

No. ________ (To be inserted by FHA or VA)

☐ Proposed Construction

☐ Under Construction

Plan #
Property address ________ City ________ State Oklahoma
Mortgagor or Sponsor ________ (Name) ________ (Address)
Contractor or Builder ________ (Name) ________ (Address)

INSTRUCTIONS

1. For additional information on how this form is to be submitted, number of copies, etc., see the instructions applicable to the FHA Application for Mortgage Insurance or VA Request for Determination of Reasonable Value, as the case may be.

2. Describe all materials and equipment to be used, whether or not shown on the drawings, by marking an X in each appropriate check-box and entering the information called for in each space. If space is inadequate, enter "See misc." and describe under item 27 or on an attached sheet. THE USE OF PAINT CONTAINING MORE THAN ONE HALF OF ONE PERCENT LEAD BY WEIGHT IS PROHIBITED.

3. Work not specifically described or shown will not be considered unless required, then the minimum acceptable will be assumed. Work exceeding minimum requirements cannot be considered unless specifically described.

4. Include no alternates, "or equal" phrases, or contradictory items. (Consideration of a request for acceptance of substitute materials or equipment is not thereby precluded.)

5. Include signatures required at the end of this form.

6. The construction shall be completed in compliance with the related drawings and specifications, as amended during processing. The specifications include this Description of Materials and the applicable Minimum Property Standards.

1. EXCAVATION:
Bearing soil, type Firm clay; Note: Where fill is in excess of 18", concrete piers to be installed at 8' oc and the cost will be added to the contract.

2. FOUNDATIONS:
Footings: concrete mix transite 14"x18" ftg; Strength psi 2500# Reinforcing (4) 5/8" steel rebar
Foundation wall: material 2500# concrete Reinforcing ________
Interior foundation wall: material 2500# concrete Party foundation wall 2500# concrete
Columns: material and sizes ________ Piers: material and reinforcing ________
Girders: material and sizes ________ Sills: material west coast utility Douglas fir with sill sealer
Basement entrance areaway ________ Window areaways ________
Waterproofing waterproof mix in concrete Footing drains open mortar joints
Termite protection pretreat soil and stem wall with Chlordane and issue 5 year warranty.
Basementless space: ground cover ________; insulation ________; foundation vents ________
Special foundations thicken slab beam with 2- 5/8" steel rebars to undisturbed soil.
Additional information: see patio details, also porch and fireplace footing.

3. CHIMNEYS:
Material brick Prefabricated (make and size) ________
Flue lining: material terra cotta Heater flue size 6" metalbestos Fireplace flue size 12"x12"
Vents (material and size): gas or oil heater ________; water heater metalbestos
Additional information: ________

4. FIREPLACES:
Type: ☐ solid fuel; ☒ gas-burning; ☐ circulator (make and size) 42" veatal damper Ash dump and clean-out metal
Fireplace: facing brick; lining firebrick; hearth brick; mantel wood
Additional information: note: fireplace stubbed and keyed for gas outlet.

5. EXTERIOR WALLS: 2 x 4 studs @ 16"oc 1/2" plywood at corners.
Wood frame: wood grade, and species w.c. utility d.f. ☒ Corner bracing. Building paper or felt 15# felt
Sheathing flintcoat polyurethane; thickness 3/4"; width 24"; ☒ solid; ☐ spaced ________" o. c.; ☐ diagonal; ________
Siding ________; grade ________; type ________; size ________; exposure ________"; fastening ________
Shingles ________; grade ________; type ________; size ________; exposure ________"; fastening ________
Stucco ________; thickness ________"; Lath ________; weight ________ lb.
Masonry veneer face brick Sills brick Lintels steel supporting brick Base flashing ________
Masonry: ☐ solid ☐ faced ☐ stuccoed; total wall thickness ________"; facing thickness ________"; facing material ________
Backup material ________; thickness ________"; bonding ________
Door sills ________ Window sills ________ Lintels ________ Base flashing ________
Interior surfaces: dampproofing, ________ coats of ________; furring ________
Additional information: two coats of exterior paint or stain as selected by owner.
Exterior painting: material ________; number of coats ________
Gable wall construction: ☐ same as main walls; ☒ other construction cedar plywood or vertical siding as shown on elevations.

6. FLOOR FRAMING:
Joists: wood, grade, and species ________; other ________; bridging ________; anchors 1/2"x8"
Concrete slab: ☐ basement floor; ☐ first floor; ☒ ground supported; ☐ self-supporting; mix 3500# transite; thickness 4"; reinforcing 6-6x10-10 wire mesh; insulation 1" perimeter; membrane waterproof concrete
Fill under slab: material sand fill; thickness 4". Additional information: ________

7. SUBFLOORING: *(Describe underflooring for special floors under item 21.)*
Material: grade and species 3/4" AC exterior plywood; size ________; type ________
Laid: ☐ first floor; ☐ second floor; ☒ attic 200 sq. ft sq. ft.; ☐ diagonal; ☐ right angles. Additional information: ________

8. FINISH FLOORING: *(Wood only. Describe other finish flooring under item 21.)*

Location	Rooms	Grade	Species	Thickness	Width	Bldg. Paper	Finish
First floor	living area, formal dining.						
Second floor	hall and bedrooms: pad and carpet installed:						allowance per square foot
Attic floor	________ sq. ft.						

Additional information: ________

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9. PARTITION FRAMING:

Studs: wood, grade, and species w.c. utility d.f. size and spacing 2x4 studs @16"oc Other ____

Additional information: NOTE: 2 x 6 studs where needed for plumbing vents.

10. CEILING FRAMING:

Joists: wood, grade, and species w.c. standard d.f. Other see floor plan Bridging 2x4 flat and 2x6 up midspan stiffener

Additional information: see typical sheet for construction details.

11. ROOF FRAMING:

Rafters: wood, grade, and species w.c. utility d.f. Roof trusses (see detail): grade and species ____

Additional information: 2x6 rafters @24"oc, unless spans exceed allowable.

12. ROOFING:

Sheathing: wood, grade, and species west coast utility Douglas fir ; ☐ solid; ☒ spaced ____" o.c.

Roofing 240 #3 tab sq. butt asphalt shingles ; grade #1 ; size ____; type ____

Underlay ____ ; weight or thickness 5/2 ; size 16" ; fastening nail

Built-up roofing ____ ; number of plies ____ ; surfacing material ____

Flashing: material galvanized iron ; gage or weight 26 gauge ; ☐ gravel stops; ☐ snow guards

Additional information: ____

13. GUTTERS AND DOWNSPOUTS: Gutter over entryway

Gutters: material galvanized iron ; gage or weight 26 gauge size 5" ; shape o-gee

Downspouts: material galvanized iron; gage or weight 26 gauge size 3"x4" ; shape square ; number as need

Downspouts connected to: ☐ Storm sewer; ☐ sanitary sewer; ☐ dry-well. ☒ Splash blocks: material and size ____

Additional information: ____

14. LATH AND PLASTER

Lath ☐ walls, ☐ ceilings: material ____; weight or thickness ____ Plaster: coats ____; finish ____

Dry-wall ☒ walls, ☒ ceilings: material Sheetrock ; thickness 1/2" ; finish medium texture ;

Joint treatment mud and tape; NOTE: Sheetrock applied according to manufacturer's specs.

15. DECORATING: *(Paint, wallpaper, etc.)*

Rooms	Wall Finish Material and Application	Ceiling Finish Material and Application
Kitchen		
Bath ALL ROOMS:	paint and/or wallpaper	all ceilings to be textured
Other		and painted two coats flat paint.
	WALLPAPER ALLOWANCE: $	(includes cost of labor)

Additional information: PANELING: 1/4" v-groove ash

16. INTERIOR DOORS AND TRIM:

Doors: type hollow core slab ; material ash or birch ; thickness 1-3/8"

Door trim: type detail ; material white pine Base: type detail ; material white pine ; size 3-1/4"

Finish: doors hand-rubbed stain ; trim hand-rubbed stain

Other trim *(item, type and location)* Note: All headers to meet schedule as shown on detail sheet.

Additional information: ____

17. WINDOWS: ALL THERMOPANE GLASS- fixed and operating.

Windows: type single hung ; make Alenco or equal ; material aluminum ; sash thickness 1"

Glass: grade DS6 ; ☐ sash weights; ☒ balances, type spring ; head flashing galvanized

Trim: type Sheetrock return ; material Sheetrock Paint texture & paint ; number coats 2

Weatherstripping: type with units ; material wool pile Storm sash, number ____

Screens: ☒ full; ☐ half; type metal or aluminum ; number all ; screen cloth material 16" aluminum mesh

Basement windows: type ____; material ____; screens, number ____; Storm sash, number ____

Special windows See plans for fixed windows

Additional information: NOTE: Sheetrock return on all windows with wood stool and apron.

18. ENTRANCES AND EXTERIOR DETAIL:

Main entrance door: material ash panel ; width see plans ; thickness 1-3/4" Frame: material w. pine ; thickness 1-1/8"

Other entrance doors: material w.p. m.c. ; width see plans ; thickness 1-3/4" Frame: material w. pine ; thickness 1-1/8"

Head flashing galvanized iron Weatherstripping: type spring bronze ; thresholds; aluminum

Screen doors: thickness ____"; number ____; screen cloth material ____ Storm doors: thickness ____"; number ____

Combination storm and screen doors: thickness ____"; number ____; screen cloth material ____

Shutters: ☐ hinged; ☐ fixed. Railings ____, Attic louvers galvanized back screen in soffit

Exterior millwork: grade and species redwood or rough cedar Paint exterior paint or stain number coats 2

Additional information: Thermopane glass sliding doors with alum. frame

19. CABINETS AND INTERIOR DETAIL:

Kitchen cabinets, wall units: material ash with white pine stiles ; lineal feet of shelves ____; shelf width 12"

Base units: material ash with white pine counter top Formica ; edging self-edge Formica

Back and end splash full Formica Finish of cabinets enamel or hand-rubbed stain number coats 5

Medicine cabinets: make ____; model ____

Other cabinets and built-in furniture Ash raised panel door and drawer fronts--shop built

Additional information: built-in vanities with synthetic marble or Formica top and splash; built-in ash bookcases (See plans)

20. STAIRS:

Stair	Treads		Risers		Strings		Handrail		Balusters	
	Material	Thickness	Material	Thickness	Material	Size	Material	Size	Material	Size
Basement										
Main										
Attic										

Disappearing: make and model number pull-down ladder to attic access in garage.2040

Additional information: ____

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21. SPECIAL FLOORS AND WAINSCOT:

FLOORS

Location	Material, Color, Border, Sizes, Gage, Etc.	Threshold Material	Wall Base Material	Underfloor Material
Kitchen	utility: sheet vinyl			
Baths	ceramic tile	ceramic	white pine	concrete
Main entry	earthstone	aluminum	white pine	concrete
Rear entry	sheet vinyl	aluminum		concrete

WAINSCOT

Location	Material, Color, Border, Cap. Sizes, Gage, Etc.	Height	Height Over Tub	Height in Showers (From Floor)
Bath	(tub & shower ceramic tile over metl lath and grout area only)		72"	72"
remainder of				
bath walls:	1/4 " v-groove ash wainscoting 32 " high			

Bathroom accessories: ☐ Recessed; material brushed chrome; number ____; ☐ Attached; material brushed chrome; number ____

Additional information: ____

22. PLUMBING:

Fixture	Number	Location	Make	Mfr's Fixture Identification No.	Size	Color
Sink	1	kitchen	Kohler	Delafield k-5950	32"x21"	color
Lavatory		baths	Kohler	Caxton k-2210	19"x15"	color
Water closet		baths	Kohler	Wellsworth k-3500 eb	reverse trap	color
Bathtub		bath	Kohler	Villager k-715	60"	color
Shower over tub△		bath	Kohler	chrome divertor over tub		
Stall shower△		bath	ceramic stall shower with glass door (job built)			
Laundry trays						
optional:	1	Kohler party bar sink with single lever faucet in utility rm.				
	NOTE:	Kohler faucets on all lavatories and sinks.				

△☒ Curtain rod △☒ Door ☐ Shower pan: material ____

Water supply: ☒ public; ☐ community system; ☐ individual (private) system.★

Sewage disposal: ☒ public; ☐ community system; ☐ individual (private) system.★

★Show and describe individual system in complete detail in separate drawings and specifications according to requirements.

House drain (inside): ☐ cast iron; ☐ tile; ☒ other ABS or PVC House sewer (outside): ☐ cast iron; ☒ tile; ☐ other 4" ABS

Water piping: ☐ galvanized steel; ☒ copper tubing; ☐ other type L hard-drawn joints. Sill cocks, number frostproof

Domestic water heater: type automatic; make and model Rheem or State; heating capacity 40 gallons

25.2 gph. 100° rise. Storage tank: material glass lined; capacity 40 gallons.

Gas service: ☒ utility company; ☐ liq. pet. gas; ☐ other ____ Gas piping: ☐ cooking; ☒ house heating.

Footing drains connected to: ☐ storm sewer; ☐ sanitary sewer; ☐ dry well. Sump pump; make and model ____

____; capacity ____; discharges into ____

23. HEATING:

☐ Hot water. ☐ Steam. ☐ Vapor. ☐ One-pipe system. ☐ Two-pipe system.

☐ Radiators. ☐ Convectors. ☐ Baseboard radiation. Make and model ____

Radiant panel: ☐ floor; ☐ wall; ☐ ceiling. Panel coil: material ____

☐ Circulator. ☐ Return pump. Make and model ____; capacity ____ gpm.

Boiler: make and model ____ Output ____ Btuh.; net rating ____ Btuh.

Additional information: ____

Warm air: ☐ Gravity. ☒ Forced. Type of system perimeter under floor

Duct material: supply concrete; return sheet metal Insulation fiberglass thickness 1" ☐ Outside air intake.

Furnace: make and model See heating and air conditioning Input 120,000 Btuh.; output 96,000 Btuh.

Additional information: Layout; to be prepared by mechanical contractor.

☐ Space heater; ☐ floor furnace; ☐ wall heater. Input ____ Btuh.; output ____ Btuh.; number units ____

Make, model ____ Additional information: ____

Controls: make and types ____

Additional information: ____

Fuel: ☐ Coal; ☐ oil; ☐ gas; ☐ liq. pet. gas; ☐ electric; ☐ other ____; storage capacity ____

Additional information: ____

Firing equipment furnished separately: ☐ Gas burner, conversion type. ☐ Stoker: hopper feed ☐; bin feed ☐

Oil burner: ☐ pressure atomizing; ☐ vaporizing ____

Make and model ____ Control ____ furnace.

Additional information: NOTE: Gas outlet for hot water tank, furnace and fireplace jet, and garage

Electric heating system: type ____ Input ____ watts; @ ____ volts; output ____ Btuh.

Additional information: ____

Ventilating equipment: attic fan, make and model ____; capacity 7,800 cfm.

kitchen exhaust fan, make and model kitchen vent hood and exhaust fan.

Other heating, ventilating, or cooling equipment Nutone or equal ceiling heaters in baths.

24. ELECTRIC WIRING: allow for 200 amp service

Service: ☐ overhead; ☐ underground. Panel: ☐ fuse box; ☒ circuit-breaker; make square D AMP's as required No. circuits ____

Wiring: ☐ conduit; ☒ armored cable; ☐ nonmetallic cable; ☐ knob and tube; ☐ other romex wiring if code allows

Special outlets: ☒ range; ☐ water heater; ☐ other 220 volt for oven, range, dryer, and air conditioning

☐ Doorbell. ☒ Chimes. Push-button locations ____ Additional information: ____

25. LIGHTING FIXTURES:

Total number of fixtures see plans Total allowance for fixtures, typical installation, $ ____

Nontypical installation ____

Additional information: Optional Fluorescent grid, dropped ceiling in kitchen as shown on plans

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DESCRIPTION OF MATERIALS

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26. INSULATION:

Location	Thickness	Material, Type, and Method of Installation	Vapor Barrier
Roof			
Ceiling	12"	loose-fill fiberglass insulation in ceiling of house only	(blown between jsts)
Wall	4"	batts- fiberglass insulation- exterior walls of house	(stapled to studs)
Floor	1"	perimeter insulation under slab.	

27. MISCELLANEOUS: *(Describe any main dwelling materials, equipment, or construction items not shown elsewhere; or use to provide additional information where the space provided was inadequate. Always reference by item number to correspond to numbering used on this form.)*

LIGHTING FIXTURES. . . . . . . $ as per contract
WALLPAPER. . . . . $ per contract labor and material
LANDSCAPING. . . . . $ as per contract
CARPET ALLOWANCE. . . . . . . $ PER SQUARE YARD INSTALLED as per contract
Cabinet over washer and dryer.
Waterproof outlet on patio.

HARDWARE: *(make, material, and finish.)*

Dexter or equal passage sets and locks- all exterior doors keyed alike.
deadbolt locks on all exterior doors.

SPECIAL EQUIPMENT: *(State material or make, model and quantity. Include only equipment and appliances which are acceptable by local law, custom and applicable FHA standards. Do not include items which, by established custom, are supplied by occupant and removed when he vacates premises or chattles prohibited by law from becoming realty.)*

APPLIANCE ALLOWANCE: $
AS SELECTED BY OWNER WITHIN SPECIFIED ALLOWANCE

PORCHES:

foundation construction: 6" x 8" poured monolithic with the slab.
floor: 4" concrete slab with 6-6 x 10-10 wire mesh: smooth trowel finish.

TERRACES:

stoops: 4" concrete slab- smooth trowel finish.
patio: 4" concrete slab- smooth trowel finish. - see plans for size.

GARAGES: automatic garage door opener
foundation: 14" x 18" concrete footing with (4) 5/8" rebars; 6" concrete stem wall
floor: 4" concrete with 6" x 6" 1010 wire mesh; smooth trowel finish floors.
interior: 3/8" prefinished Sheetrock on walls; texture and paint 1/2" Sheetrock on ceiling

WALKS AND DRIVEWAYS:

Driveway: width see plot base material tamped earth; thickness 4"; surfacing material concrete; thickness 4"
Front walk: width 36"; material concrete; thickness 4". Service walk: width ____; material ____; thickness ____"
Steps: material ____; treads ____"; risers ____". Cheek walls ____

OTHER ONSITE IMPROVEMENTS:

(Specify all exterior onsite improvements not described elsewhere, including items such as unusual grading, drainage structures, retaining walls, fence, railings, and accessory structures.)

NOTE: All dimensions to be rechecked on site prior to beginning construction by builder and builder shall be responsible for the same.

LANDSCAPING, PLANTING, AND FINISH GRADING:

Topsoil ____" thick: ☐ front yard; ☐ side yards; ☐ rear yard to ____ feet behind main building.
Lawns *(seeded, sodded, or sprigged)*: ☐ front yard ____; ☐ side yards ____; ☐ rear yard ____
Planting: ☐ as specified and shown on drawings; ☐ as follows:

____ Shade trees, deciduous, ____" caliper.		____ Evergreen trees.	____' to ____', B & B.
____ Low flowering trees, deciduous,	____' to ____'	____ Evergreen shrubs.	____' to ____', B & B.
____ High-growing shrubs, deciduous,	____' to ____'	____ Vines, 2-year	____
____ Medium-growing shrubs, deciduous,	____' to ____'		
____ Low-growing shrubs, deciduous,	____' to ____'		

IDENTIFICATION.—This exhibit shall be identified by the signature of the builder, or sponsor, and/or the proposed mortgagor if the latter is known at the time of application.

Date ____ Signature ____

Signature ____

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4

GPO : 1976 O - 219-069

PLAN READING
UNIT III

ASSIGNMENT SHEET #1 — READ PLANS

NAME ______________________________________ SCORE ______________

A carpenter learns to read plans by learning what information each type of drawing in a set of plans contains, by learning the meanings of the architectural terms used for each part of a building, by understanding the many abbreviations used in plans, by learning to visualize plans drawn to scales that are only fractional parts of full size, by being thoroughly acquainted with all dimensioning procedures, and by being able to recognize the many types of lines used on plans. Once you have learned these basics, you will be able to visualize. Each mark on the plan will mean something to you, just as the letters of the alphabet mean something when you are reading this paragraph.

This assignment sheet is designed to help you become more familiar with the different drawings in a set of plans. It should also give you an idea of what to look for when reading plans, and should provide practice for learning the fundamentals of plan reading. Refer to the set of plans in Assignment Sheet Supplement #1 to answer the following questions. Remember that you may have to refer to detail and section drawings to answer all questions about a plan.

A. Plot plan

____________________ 1. What are the overall outside dimensions of the building?

____________________ 2. What is the elevation of the bench mark?

____________________ 3. In what compass direction is the long dimension of the lot?

____________________ 4. In what direction does the residence face?

____________________ 5. How far is the residence from the east property line?

____________________ 6. On what two sides of the property is the split-rail fence?

____________________ 7. How far is the northeast corner of the residence from the north property line?

____________________ 8. How far is the southwest corner of the residence from the south property line?

____________________ 9. What is the finish floor elevation?

____________________ 10. What is the scale of this drawing?

B. Foundation plan

____________________ 1. How thick is the concrete slab in the garage?

ASSIGNMENT SHEET #1

____________________ 2. What size and type of reinforcing are used in the building slab?

____________________ 3. How wide is the footing on the building?

____________________ 4. How wide are the stem walls?

____________________ 5. What is the drop from finish grade to the porch slab?

____________________ 6. What is the thickness of the sheathing?

____________________ 7. How many reinforcing rods are used in the exterior footings?

____________________ 8. What is the radius of the garage floor at the door edge?

____________________ 9. What size anchor bolts are to be used throughout?

____________________ 10. How much is the garage floor sloped from the inside wall out?

____________________ 11. What type of insulation is used for the vapor barrier?

____________________ 12. In which detail are the stem wall and the floor poured monolithic?

____________________ 13. What is the depth of the fireplace footing?

____________________ 14. On which details do you find expansion joints?

____________________ 15. What material is used as fill beneath the concrete slab?

C. Floor plan

____________________ 1. What is the size of bedroom #2?

____________________ 2. What is the height of the fireplace hearth?

____________________ 3. How many different types of windows are used in the residence?

____________________ 4. What are the dimensions of the living room?

____________________ 5. What is the size of the main entry door?

____________________ 6. How many square feet of living space will there be?

____________________ 7. What are the dimensions of the master bedroom?

ASSIGNMENT SHEET #1

____________________ 8. What is the thickness of the exterior walls?

____________________ 9. What is the swing of the main entry door?

____________________ 10. What is the size of the closet in the master bedroom?

____________________ 11. How many bathrooms does the residence contain?

____________________ 12. Where are the washer and dryer to be located?

____________________ 13. Where is the water heater to be located?

____________________ 14. How many hose bibbs are there, and where are they located?

____________________ 15. What size doors are used on the closets in bedrooms #2 and #3?

____________________ 16. What type of door is used between the kitchen and hallway?

____________________ 17. What is the size of the patio?

____________________ 18. What size is the furnace room?

____________________ 19. What are the dimensions of the planter?

____________________ 20. What does the number symbol 2668 mean?

____________________ 21. What is the radius of the curved edges of the patio?

____________________ 22. What do the circled letters mean?

____________________ 23. What type of door is used between the kitchen and utility room?

____________________ 24. Is the dining room a separate room or an area at the end of the living room and kitchen?

____________________ 25. On what wall (compass direction) will the range be located?

____________________ 26. What type of sink will be installed in the kitchen?

____________________ 27. How many windows face north?

____________________ 28. How many windows face west?

____________________ 29. Of what material is the planter made?

____________________ 30. How many exterior doors are there?

ASSIGNMENT SHEET #1

____________________31. What is the depth of the garage cabinets?

____________________32. What is the swing of the cabinet doors over the washer and dryer?

____________________33. How many shelves will the bookcase contain?

____________________34. How deep is the counter overhang on the vanities in the baths?

____________________35. Does the kitchen sink contain a garbage disposer?

____________________36. Of what material is the fireplace mantel made?

D. Elevation views

____________________1. What is the top height of the windows and doors?

____________________2. How deep is the cornice overhang?

____________________3. How many downspouts will be installed?

____________________4. What size and type of bricks are used on the building?

____________________5. What is the roof pitch?

____________________6. What is the ceiling height of the garage?

____________________7. What are the size and spacing of the rafters?

____________________8. What type of 2×4s are used for the bottom plates?

____________________9. What are the size and spacing of the ceiling joists?

____________________10. What type of sheathing will be used on the roof?

PLAN READING
UNIT III

ASSIGNMENT SHEET #2 — INTERPRET A FINISH SCHEDULE

NAME ______________________________ SCORE ______________

Learning to read a finish schedule as keyed to the plans is an important part of plan reading. The finish schedules provided with the set of plans in Assignment Sheet Supplement #1 provide listings of all opening sizes, types of materials used, walls to be painted and types of paint to use, types of finish floors, and sizes of headers to be used over openings.

Refer to the finish schedule included in Assignment Sheet Supplement #1 to answer the following questions.

______________ A. What is the size of the entry door?

______________ B. What type of door and material are to be used for the main entry?

______________ C. What type of threshold is used for the 3668 door?

______________ D. What type of material is used in the fireproof door?

______________ E. What type of doors are used in bedrooms #2 and #3?

______________ F. How many hollow-core doors will be used?

______________ G. How many different types of doors will be used?

______________ H. What is the size of the window on the south side of the residence?

______________ I. What type of window is the east window marked B?

______________ J. Which rooms will be painted with light-blue gloss enamel?

______________ K. How many rooms will be painted with off-white flat latex?

______________ L. What type of floor is used in the entry?

______________ M. Which rooms have carpeting on the floors?

______________ N. What type of base is to be used in the bedrooms?

______________ O. With what are the walls in the dining area finished?

PLAN READING
UNIT III

ASSIGNMENT SHEET #3 — READ WRITTEN SPECIFICATIONS

NAME ______________________________ SCORE ______________

Both specifications and plans may indicate information about the same items. The symbols and notes appearing on an elevation or plan view, for example, may completely describe a certain aspect of construction. In that event, the written specifications need not repeat the same information. When, however, symbols and notes do not contain complete information, then specifications must include whatever additional information may be required. For example, section and detail views may indicate that subflooring is required. That is not enough information. So, the specifications would have to show the size of the boards to use, the type of boards to use, how the boards are to be mill-finished, and how nailed. Therefore, when you study plans and specifications, you must pay careful attention to what is shown on the plans, as well as to what is set forth in the specifications. A good carpenter cannot possibly obtain a full understanding of all requirements until he or she is thoroughly familiar with both plans and written specifications.

Use the set of written specifications in Assignment Sheet Supplement #2 to answer the following questions. Do not use abbreviations in your answers.

A. What restriction is applied to the general type of paint that may be used?

____

B. Foundation

1. Under what conditions must concrete piers be installed?

____

2. What type of reinforcing is to be used in the foundation? ______________

3. Of what material are the foundation sills to be made?

____

4. How is the foundation to be waterproofed?

____

5. With what is the soil to be treated to protect against termites? ______________

C. Chimneys and fireplaces

1. What is the size of the fireplace flue? ______________

2. What type of flue-liner material is to be used? ______________

ASSIGNMENT SHEET #3

3. What material is to be used in the fireplace hearth? ______________________

4. List additional information given for the fireplace specifications.

   ____

D. Floors and exterior walls

1. What type of wood grade and species are to be used on the house frame?

   ____

2. What size and type sheathing material will be used on the exterior walls?

   ____

3. What type of veneer is to be applied to the exterior walls? ________________

4. What materials may be used in the gable wall construction?

   ____

5. What type of reinforcing is to be used in the floor? ______________________

6. How many square units of subflooring are to be installed in the attic? __________

E. Partition framing, ceiling framing, and roof

1. What are the size and spacing of the partition studs?

   ____

2. What specifications are given for ceiling bridging?

   ____

3. What is the distance between rafter centers in the roof framing? ____________

4. What type and grade of roofing material will be used?

   ____

5. What flashing material will be used? ______________________________

6. What is the shape of the guttering, and what size guttering is to be used?

   ____

7. Is the guttering to be connected to the storm sewer? Explain.

   ____

ASSIGNMENT SHEET #3

F. Interior ceiling, doors, trim, and windows

1. How are the joints in the Sheetrock ceilings to be treated?

    ____

2. How many coats of paint are to be applied to the ceilings? ______________

3. What type of doors are to be used on the interior? ____________________

4. What types of finishes are allowed for the interior doors and trim?

    ____

5. What type and brand of windows are to be installed?

    ____

6. What type of glass will the windows contain? ______________________

G. Entrances, cabinets, and interior detail

1. What materials are to be used for entrance doors other than the main door?

    ____

2. What framing material is to be used on the entrance doors? ______________

3. What type of window glass is to be installed in the patio door?

    ____

4. How many coats of finish are to be applied to the kitchen cabinets? _________

5. What is to be the width of the shelves in the kitchen cabinets? ___________

6. Does the house contain interior stairs? __________________________

7. Where is the attic access to be located? __________________________

8. What type of floor material is to be used in the kitchen and utility room?

    ____

9. What type of threshold material is to be used in the main entry? ___________

10. How high is the wainscoting in the bath? _________________________

ASSIGNMENT SHEET #3

H. Plumbing, heating, lighting, and insulation

1. Will the shower have a curtain or a door?____________________
2. What capacity water heater is to be installed?____________________
3. Will the water heater be gas or electric?____________________
4. Where will the heating vents be located?____________________
5. Will there be a ceiling heater in the bath?____________________
6. What is to be the finish on the faucets and accessories in the bath?

   ____
7. What type of insulation is to be used in the walls?____________________
8. How is the wall insulation to be installed?____________________

I. Miscellaneous

1. What is to be the finish on the concrete of the porch floor, stoops, and patio?

   ____
2. With what will the interior walls of the garage be finished?

   ____
3. Will the driveway be asphalt, gravel, or concrete?____________________
4. What brand of locks are suggested for all exterior doors?____________________
5. Will the doorbell ring or chime?____________________

PLAN READING
UNIT III

ASSIGNMENT SHEET #4 — USE AN ARCHITECT'S SCALE

NAME ________________________________ SCORE ________________

Carpenters need to be skilled in using an architect's scale. Learning to read an architect's scale proficiently also aids in reading plans.

Use an architect's scale to complete this assignment sheet. Keep in mind the following guidelines.

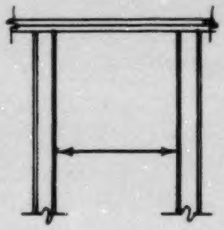
- Select proper scale ratio.
- Be sure that scale is lying flat on surface being measured.
- Double-check all measurements.
- Practice measuring from center of one line to center of next line.
- Do not use scale if dimensions are available.

(NOTE: Accuracy may vary because of distortion due to the plan reproduction process.)

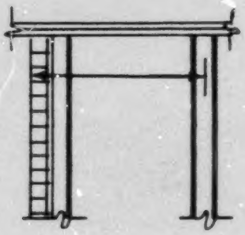
PART I

Use the architect's scale to find the following dimensions. Write your answers in the blanks.

________________ A. Scale to 1/16" = 1'-0"

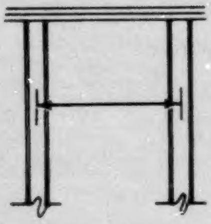


________________ B. Scale to 1/8" = 1'-0"

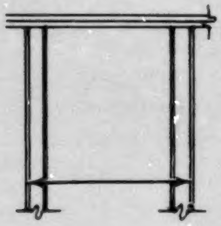


ASSIGNMENT SHEET #4

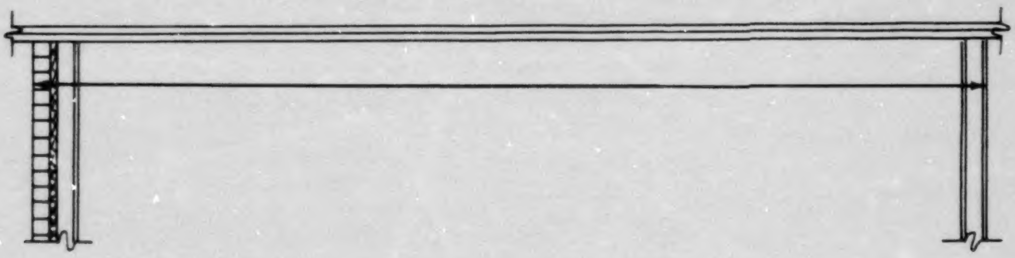
____________________C. Scale to 1/4" = 1'-0"



____________________D. Scale to 1/2" = 1'-0"



____________________E. Scale to 1 1/2" = 1'-0"

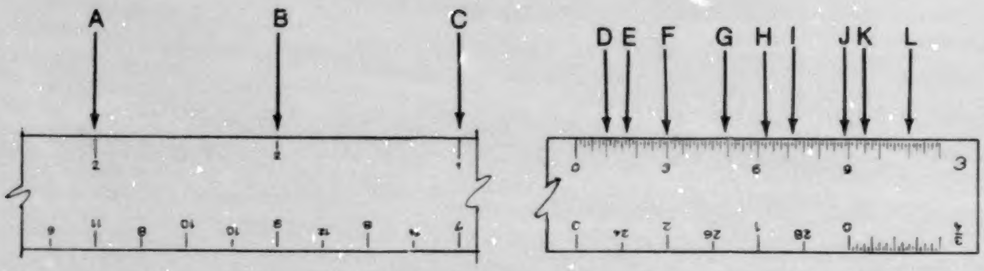


PART II

Read the following scales from zero to the letter points indicated. Write the correct readings in the blanks below the scales.

ASSIGNMENT SHEET #4

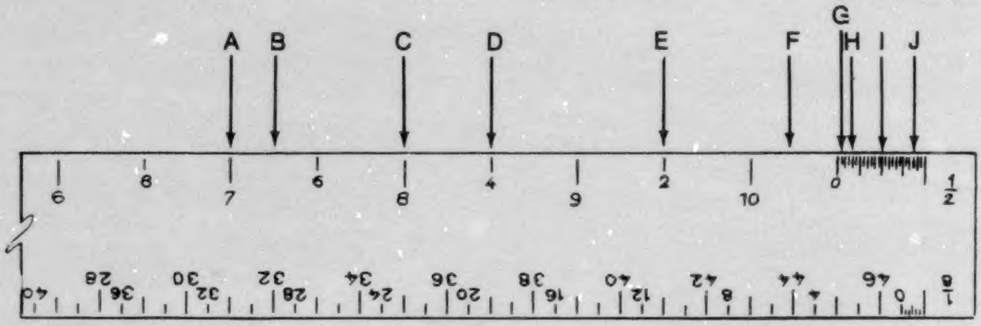
A.


A
B
C
D
E
F
G
H
I
J
K
L
0
3
6
9
3
3/4

(NOTE: This illustration has been reduced).

1. A = ____________________
2. B = ____________________
3. C = ____________________
4. D = ____________________
5. E = ____________________
6. F = ____________________
7. G = ____________________
8. H = ____________________
9. I = ____________________
10. J = ____________________
11. K = ____________________
12. L = ____________________

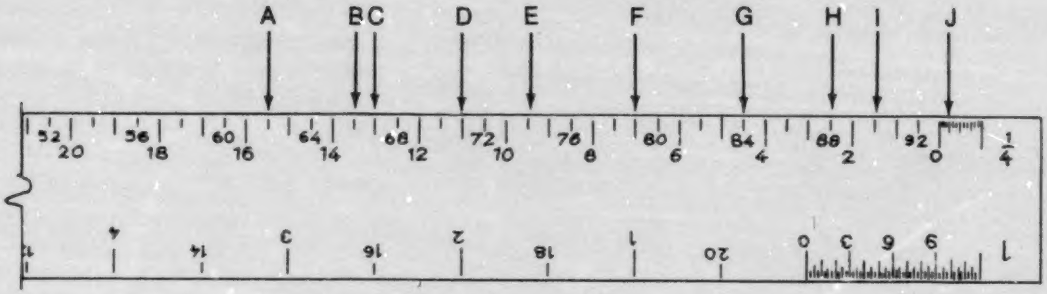
B.


A
B
C
D
E
F
G
H
I
J
6
7
8
9
10
0
1/2
1/8

1. A = ____________________
2. B = ____________________
3. C = ____________________
4. D = ____________________
5. E = ____________________
6. F = ____________________
7. G = ____________________
8. H = ____________________
9. I = ____________________
10. J = ____________________

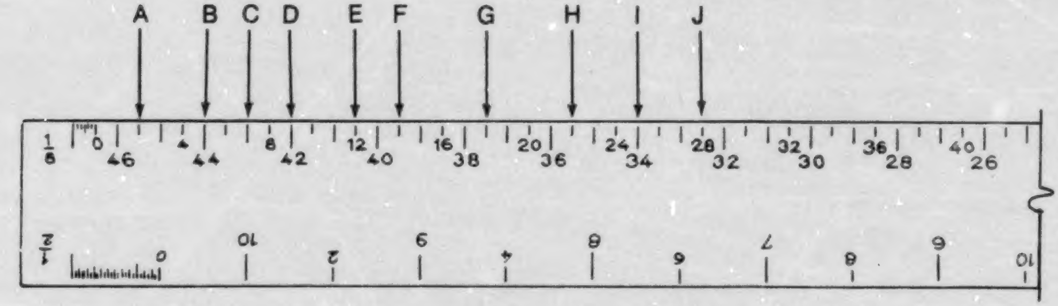
ASSIGNMENT SHEET #4

C.


A
B
C
D
E
F
G
H
I
J
52
56
60
64
68
72
76
80
84
88
92
20
18
16
14
12
10
8
6
4
2
0
1/4
0
3
6
9

1. A = ____________________
2. B = ____________________
3. C = ____________________
4. D = ____________________
5. E = ____________________
6. F = ____________________
7. G = ____________________
8. H = ____________________
9. I = ____________________
10. J = ____________________

D.


A
B
C
D
E
F
G
H
I
J
1/8
0
4
8
12
16
20
24
28
32
36
40
46
44
42
40
38
36
34
32
30
28
26
0
10

1. A = ____________________
2. B = ____________________
3. C = ____________________
4. D = ____________________
5. E = ____________________
6. F = ____________________
7. G = ____________________
8. H = ____________________
9. I = ____________________
10. J = ____________________

PLAN READING
UNIT III

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

A.
1. 51′ –9″ × 57′ –0″
2. 296′ –4″
3. North
4. West
5. 40′ –0″
6. East and south
7. 47′ –6″
8. 27′ –6″
9. 300′ –10″
10. 1″ = 20′ –0″

B.
1. 4″
2. 6-6 × 10-10 wire mesh
3. 14′
4. 6″
5. ¾″
6. ¾″
7. Four
8. ¾″
9. ½″ × 8″
10. 2″
11. Rigid
12. 7D
13. 12″
14. 7C and 7D
15. Sand

C.
1. 11′ –4¼″ × 13′ –7½″
2. 12½″
3. Six
4. 20′ –½″ × 15′ –6″
5. 3′ –6″ × 6′ –8″ or 3668
6. Approx. 1900 square feet
7. 13′ –0″ × 16′ – 3¾″
8. 8½″
9. Left-handed
10. 6′ – 3¾″ × 7′ –7½″
11. Two
12. South wall of utility room
13. Hall closet behind planter
14. Two; between windows A and B in rear, and to left of window F in front
15. 6′ –0″ × 6′ –8″ or 6068
16. Cafe
17. 14′ –8″ × 28′ –0″
18. 3′ –5″ × 3′ –6″
19. 2′ –0″ × 4′ –2″ × 2′ –4⅛″
20. A door 2′ –6″ × 6′ –8″
21. 4′
22. Codes for window schedules
23. Sliding pocket
24. Area at end of living room and kitchen
25. South
26. Double residential
27. None
28. Three
29. Brick
30. Three
31. 16″
32. Left hand and right hand
33. Four adjustable; five total
34. 1″
35. Yes
36. Oak

D.
1. 6′ –8″
2. 21″
3. Six
4. 2¾″ × 2¾″ × 9½″ nonmodular
5. 5/12
6. Varies from 8′ –7″ to 8′ –9″
7. 2×6s, 2′ –0″ on center
8. Treated
9. 2×6s, 16″ on center
10. Plywood

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #2

A. 3′-6″ × 6′-8″ or 3668
B. Solid core, ash
C. Aluminum
D. Metal clad
E. Bifold
F. Fourteen
G. Seven
H. 2′-0″ × 3′-0″ or 2030
I. Double hung
J. None
K. Five, utility room and four closets
L. Ceramic tile
M. Hall, bedrooms, closets, dining, living, and part of bath #1
N. Wood
O. Drywall, paint, wallpaper

Assignment Sheet #3

A. May not contain more than five-tenths of one-percent lead by weight

B.
  1. Where fill is in excess of 18″
  2. 5/8″ steel rebar
  3. West coast utility Douglas fir
  4. Sill sealer and waterproof mixture in concrete
  5. Chlordane

C.
  1. 12″ × 12″
  2. Terra cotta
  3. Brick
  4. Fireplace is to be stubbed and keyed for gas outlet

D.
  1. West coast utility Douglas fir
  2. 3/4″ flintcoat polyurethane 24″ wide
  3. Face brick
  4. Cedar plywood or vertical siding
  5. 6-6 × 10-10 wire mesh
  6. 200 square feet

E.
  1. 2×4 studs at 16″ on center
  2. 2×4 flat and 2×4 up, midspan stiffener
  3. 24″
  4. 240 #3 tab, square butt, asphalt shingles, grade #1
  5. Galvanized iron
  6. 5″ o-gee
  7. No, water will drain onto splash blocks

F.
  1. With mud and tape
  2. Two
  3. Hollow-core slab
  4. Hand-rubbed stain
  5. Single-hung Alenco or equal
  6. Double-strength glass

ANSWERS TO ASSIGNMENT SHEETS

G.
1. Fireproof, metal clad, aluminum and glass
2. White pine
3. Thermopane glass
4. Five
5. 12"
6. Only pull-down ladder to attic access
7. Garage
8. Sheet vinyl
9. Aluminum
10. 32"

H.
1. Door
2. 40 gallon
3. Gas
4. Perimeter under floor
5. Yes
6. Brushed chrome
7. 4-inch batts of fiberglass
8. Stapled to studs

I.
1. Smooth trowel finish
2. $^{3}/_{8}$" prefinished Sheetrock
3. Concrete
4. Dexter
5. Chime

Assignment Sheet #4

Part I

(NOTE: Answers may vary slightly due to printing distortions.)

A. 11'-3"
B. 8'-1"
C. 3'-4"
D. 1'-11"
E. 3'-8"

Part II

A.
1. 2'-0"
2. 1'-6"
3. 1'-0"
4. 1"
5. $1^{5}/_{8}$"
6. 3"
7. $4^{7}/_{8}$"
8. $6^{1}/_{4}$"
9. $7^{1}/_{8}$"
10. $8^{7}/_{8}$"
11. $9^{1}/_{2}$"
12. 11"

B.
1. 7'-0"
2. 6'-6"
3. 5'-0"
4. 4'-0"
5. 2'-0"
6. 6"
7. $^{1}/_{2}$"
8. 2"
9. 6"
10. $10^{1}/_{2}$"

ANSWERS TO ASSIGNMENT SHEETS

C. 1. 15'-6"
2. 13'-6"
3. 13'-0"
4. 11'-0"
5. 9'-6"
6. 7'-0"
7. 4'-6"
8. 2'-6"
9. 1'-6"
10. 3"

D. 1. 2'-0"
2. 5'-0"
3. 7'-0"
4. 9'-0"
5. 12'-0"
6. 14'-0"
7. 18'-0"
8. 22'-0"
9. 25'-0"
10. 28'-0"

PLAN READING
UNIT III

TEST

NAME ____________________________________ SCORE ______________

1. Match the following terms associated with plan reading to their correct definitions. Write the correct numbers in the blanks. Definitions are continued on the next page.

_____a. Lines used on plot plans and topographical surveys to show both natural grade and finish grade elevations

_____b. Reproductions of architect's drawings; also called *plans* or *construction plans*

_____c. Using conventional dimension lines and figures to indicate actual sizes and distances of objects and spaces represented

_____d. Exact measured size of a unit

_____e. Given grade

_____f. Three-sided rule with six ruled faces designed to measure in twelve different scales of proportional feet and inches

_____g. Important aspect of plan reading that involves looking at and thinking about a structural detail, or a symbol for such a detail, and being able to form a mental picture of how such a detail is constructed or assembled

_____h. Drawing made to a size either proportionally larger or smaller than the actual size of the object represented

_____i. Drawing having many of the features of a photograph; drawn by the architect to interest buyers

_____j. Drawing showing location and details about plumbing and electrical components and heating and air-conditioning units

_____k. Approximate or rough size of a unit

_____l. Point of known or assumed elevation used by surveyor as a reference point in determining other elevations

1. Architect's drawings
2. Blueprints
3. Perspective drawing
4. Structural drawing
5. Mechanical drawing
6. Visualization
7. Specifications
8. Finish schedule
9. Architect's scale
10. Scale drawing
11. Convention
12. Dimensioning
13. Nominal dimension
14. Actual dimension
15. Elevation
16. Bench mark
17. Contour lines
18. Topographical survey

TEST

______m. Detailed set of written instructions that supplements the set of plans, describes equipment and materials used in the structure, and becomes a part of the contract

______n. Listing or chart of parts (keyed to the plans), amounts, materials or products, and details

______o. Drawing of natural and man-made features of a place or region showing their relative positions and elevations

______p. Architect's standard methods of representing dimensions and structural details

______q. Drawing by a structural engineer that may accompany architect's plans and that gives important information about foundation, skeleton, and floor system

______r. Set of detailed working drawings or plans drawn to scale by an architect, showing all information and dimensions necessary to build or remodel a structure; original drawings from which blueprints are made

2. Match to their correct descriptions types of drawings usually included in a set of plans. Write the correct numbers in the blanks.

______a. Horizontal view of building, showing length and breadth of building and layout of rooms on that floor

______b. Horizontal view showing where building is to be located on site

______c. Cut-away vertical view through an object or wall to show its interior makeup

______d. Vertical, two-dimensional view of each of the exterior faces of a building, showing general shape and design of exterior and roof

______e. Graphic, at a larger scale, of part of another drawing, indicating special features of design, location, and composition and the correlation of the elements and materials shown

______f. Horizontal view of entire masonry substructure below first floor or frame of building

1. Plot plan
2. Foundation plan
3. Floor plan
4. Elevation
5. Section
6. Detail

TEST

3. List information found on types of drawings in a set of plans.

   a. Plot plan (List four.)

      1) ______________________________
      2) ______________________________
      3) ______________________________
      4) ______________________________

   b. Foundation plan (List two.)

      1) ______________________________
      2) ______________________________

   c. Floor plan (List five.)

      1) ______________________________
      2) ______________________________
      3) ______________________________
      4) ______________________________
      5) ______________________________

   d. Elevation (List four.)

      1) ______________________________
      2) ______________________________
      3) ______________________________
      4) ______________________________

   e. Section (List three.)

      1) ______________________________
      2) ______________________________
      3) ______________________________

   f. Detail (List six.)

      1) ______________________________
      2) ______________________________

TEST

3) ______________________________

4) ______________________________

5) ______________________________

6) ______________________________

4. Match lines in the alphabet of lines to their correct uses. Write the correct numbers in the blanks.

_____a. Used to connect a note or dimension to a related part of the drawing

_____b. Used to show main outline of structure, including exterior walls, interior partitions, porches, patios, sidewalks, parking lots, and driveways

_____c. Used as parameters for dimension lines

_____d. Used to designate object and area dimensions

_____e. Used to indicate alternate positions of moving parts, adjacent positions of related parts, and for repeated details

_____f. Used to indicate an area that has been cut away and shown in a section view; arrows indicate direction from which section drawing is to be viewed

_____g. Used to show lines that are not visible from view depicted

_____h. Used to show that an object or area has not been drawn in its entirety

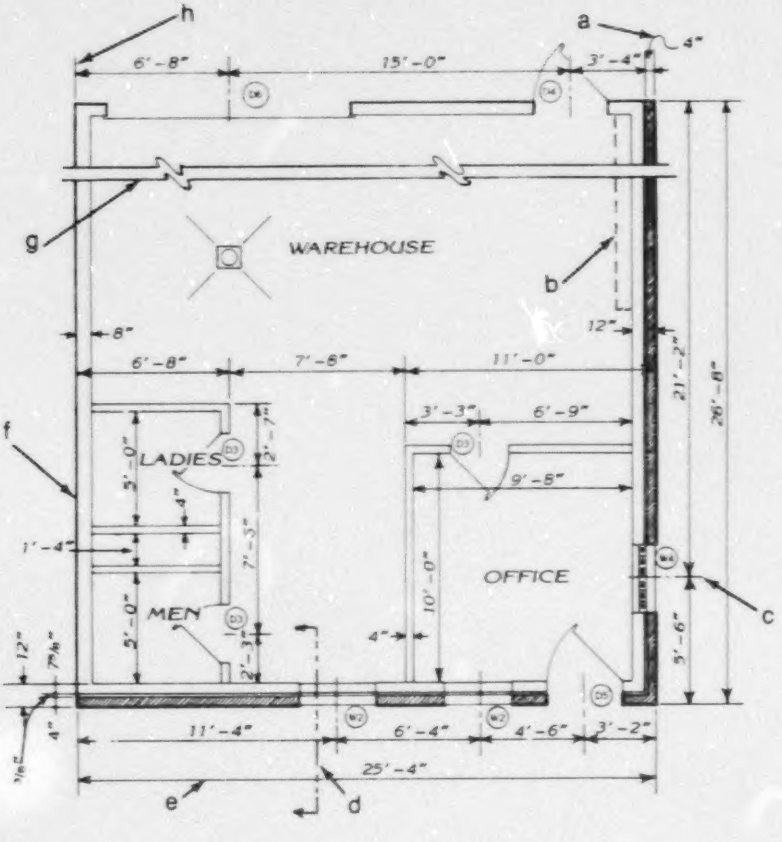
_____i. Used to designate center and to provide a reference point for dimensioning

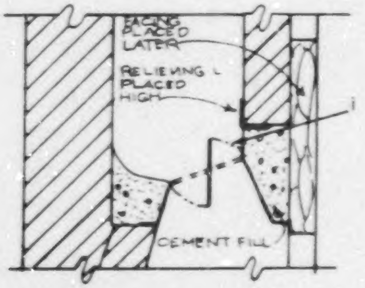
1. Object lines
2. Dimension line
3. Extension lines
4. Hidden line
5. Break line
6. Center line
7. Cutting plane (section line)
8. Phantom line
9. Leader line

TEST

5. Identify lines in the alphabet of lines. Write the correct letters in the blanks.

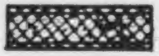
______**Object line**
______**Dimension line**
______**Extension lines**
______**Hidden line**
______**Center line**
______**Cutting plane (section line)**
______**Break line**
______**Phantom line**
______**Leader line**

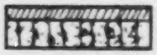

h
a
4"
6'-8"
15'-0"
3'-4"
D6
D4
g
WAREHOUSE
b
12"
8"
6'-8"
7'-8"
11'-0"
21'-2"
26'-8"
3'-3"
6'-9"
D3
LADIES
2'-7"
5'-0"
4"
9'-8"
f
1'-4"
7'-3"
10'-0"
W4
OFFICE
c
MEN
D3
5'-0"
2'-3"
4"
12"
7⅝"
5'-6"
D5
W2
W2
4"
11'-4"
6'-4"
4'-6"
3'-2"
25'-4"
e
d

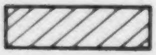

FACING PLACED LATER
RELIEVING L PLACED HIGH
i
CEMENT FILL

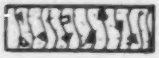
TEST

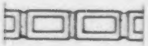
6. Identify the following selected architectural symbols commonly used to represent materials on plans. Write the correct names in the blanks.

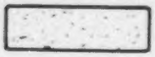

a. ______________________________

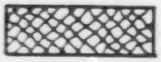

b. ______________________________

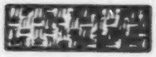

c. ______________________________

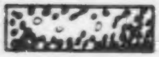

d. ______________________________

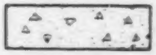

e. ______________________________

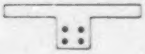

f. ______________________________

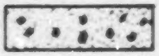

g. ______________________________

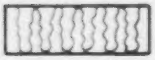

h. ______________________________

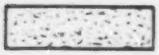

i. ______________________________

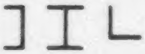

j. ______________________________

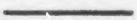

k. ______________________________


l. ______________________________


m. ______________________________


n. ______________________________

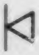

c. ______________________________

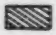

p. ______________________________

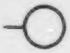
TEST

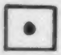
7. Identify the following selected electrical symbols commonly used on plans. Write the correct names in the blanks.

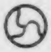
________________ a. S_{WP}

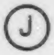
________________ b. 

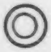
________________ c. 

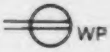
________________ d. 

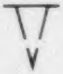
________________ e. 

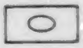
________________ f. 

________________ g. 

________________ h. 

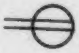
________________ i. 

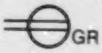
________________ j. 

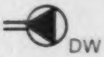
________________ k. 

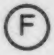
________________ l. S_{CB}

________________ m. S

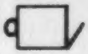
________________ n. 

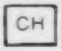
________________ o. 

________________ p. 

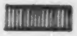
________________ q. 

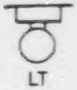
________________ r. S_P

________________ s. 

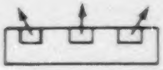
________________ t. 

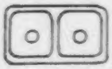
8. Identify the following selected mechanical symbols commonly used on plans. Write the correct names in the blanks.

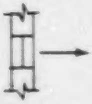
________________ a. 

________________ b. 

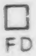
________________ c.

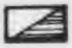
________________ d. 

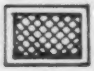
________________ e. 

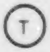
________________ f. 

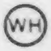
________________ g.

________________ h. 

________________ i. 

________________ j. 

________________ k. 

________________ l. 

TEST

9. Identify the following selected abbreviations commonly used on plans. Write in the blanks the full word or words for the abbreviated word or words.

______________________ a. 16" CC

______________________ b. OAK FIN FL

______________________ c. BATT INS

______________________ d. 3′-6" MO

______________________ e. CONC B WALL

______________________ f. SSG WINDOW

______________________ g. EQUAL FROM CTR

______________________ h. ½" EXP JT

______________________ i. SP TO SEWER

______________________ j. TC TILE

______________________ k. ½" BRG PL

______________________ l. FS DET

______________________ m. 14 R UP

______________________ n. CHIMNEY COD

______________________ o. DSG IN SIDE LIGHTS

______________________ p. PL ARCH

______________________ q. HB 1′-6" FROM GR

______________________ r. 2×4 PL

______________________ s. CABINET HDW

______________________ t. REINF CONC APRON

______________________ u. DH WINDOW NTS

______________________ v. LINTEL ∠ IRON

______________________ w. WH 48" OC

______________________ x. SEE SPEC

______________________ y. STR STL

______________________ z. BM 114′

TEST

10. Match the following architect's conventions to their correct representations. Write the correct numbers in the blanks. Representations are continued on the next page.

______a. Doors and windows in brick veneer and wood stud walls

______b. Doors and windows in concrete wall

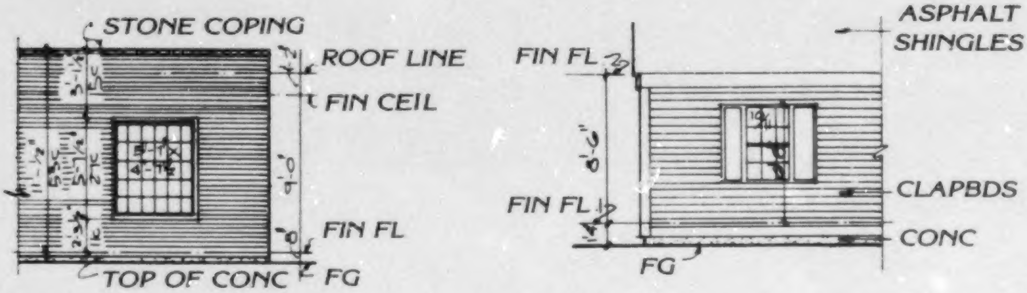
______c. Dimensioning exterior and interior walls

______d. Doors and windows in solid brick wall

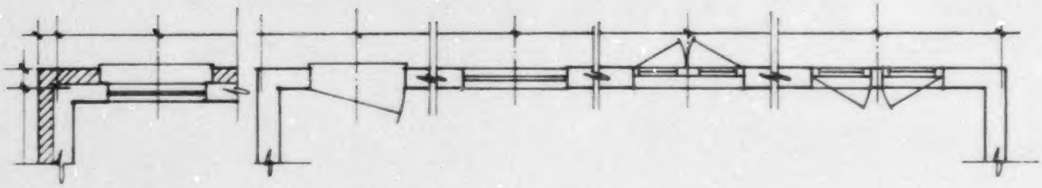
______e. Window elevations

______f. Interior dimensions and alterations

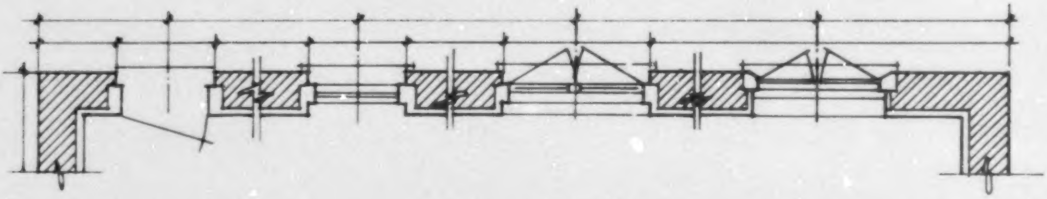
1.


STONE COPING
ROOF LINE
FIN CEIL
FIN FL
TOP OF CONC
FG
ASPHALT SHINGLES
FIN FL
8'-0"
FIN FL
CLAPBDS
CONC
FG

2.

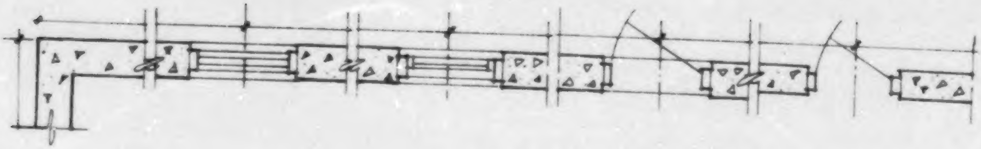


3.

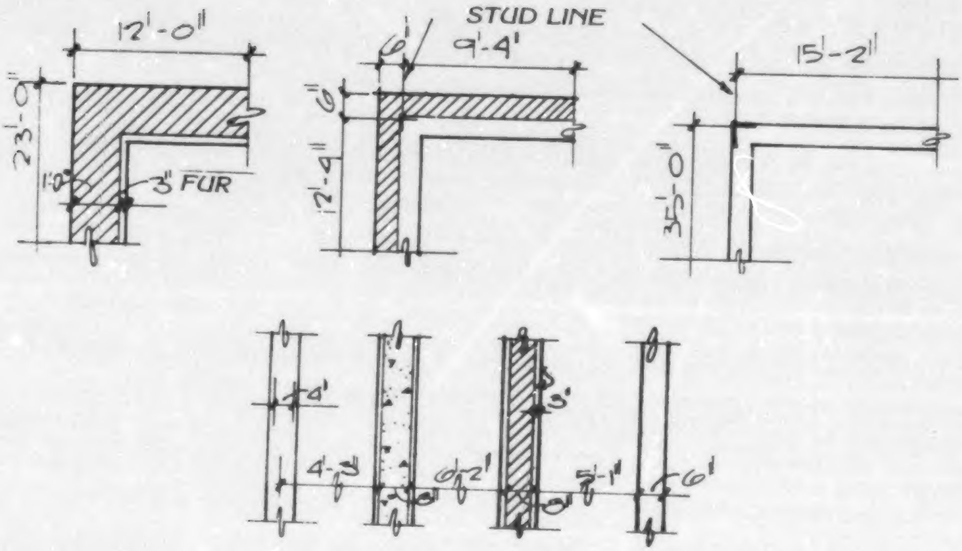


TEST

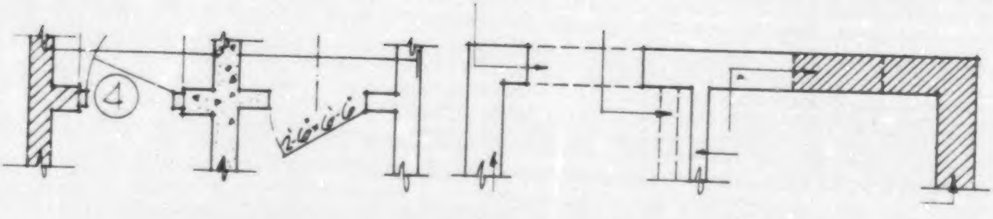
4.



5.


12'-0"
23'-0"
1'-0"
3" FUR
STUD LINE
6'
9'-4'
6"
12'-9"
15'-2"
35'-0"
4'
4'-3"
6'-2'
6'
3'
5'-1"
6'

6.



TEST

11. State the purposes of written specifications.

a. ________________________________

____

b. ________________________________

____

c. ________________________________

____

d. ________________________________

____

e. ________________________________

____

12. List basic information included in a set of written specifications.

a. ________________________________

b. ________________________________

c. ________________________________

d. ________________________________

e. ________________________________

f. ________________________________

g. ________________________________

h. ________________________________

i. ________________________________

j. ________________________________

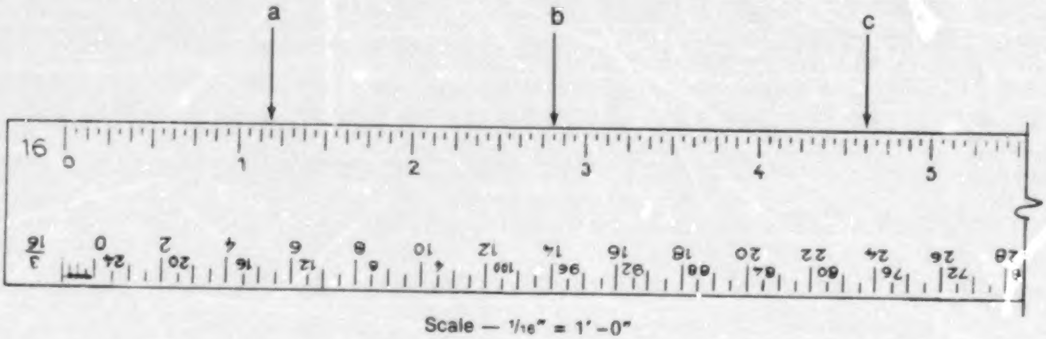
k. ________________________________

l. ________________________________

m. ________________________________

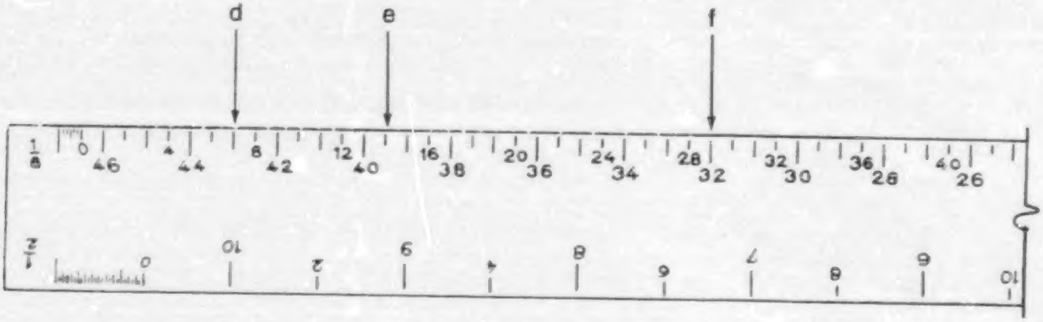
TEST

13. Read the measurements on the following architect's scales. Use the scales given, and write the correct answers in the corresponding blanks.

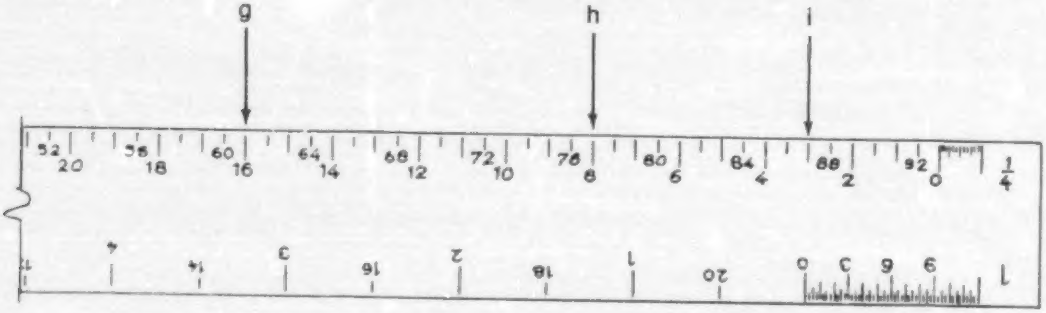

a
b
c
16
0
1
2
3
4
5
3/16

Scale — 1/16" = 1'-0"

a. ____________ b. ____________ c. ____________

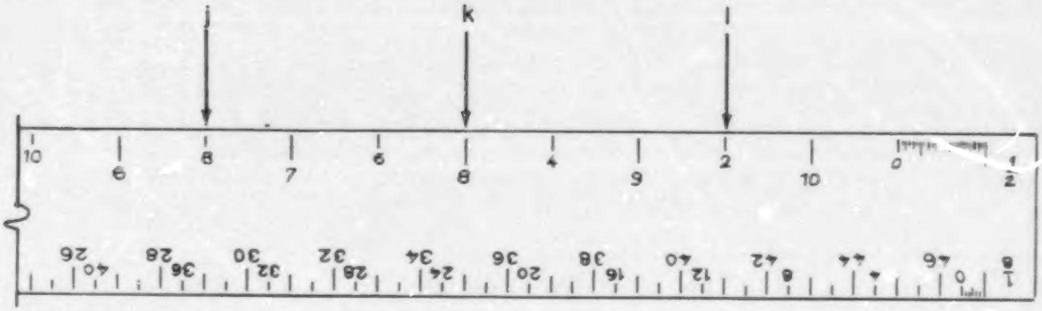

d
e
f
1/8
0
4
8
12
16
20
24
28
32
36
40
46
44
42
40
38
36
34
32
30
28
26
1/4

d. ____________ e. ____________ f. ____________

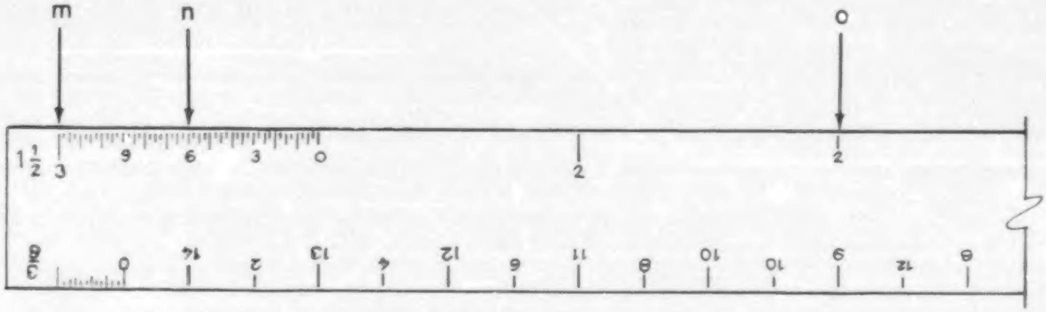

g
h
i
52
56
60
64
68
72
76
80
84
88
92
20
18
16
14
12
10
8
6
4
2
0
1/4

g. ____________ h. ____________ i. ____________

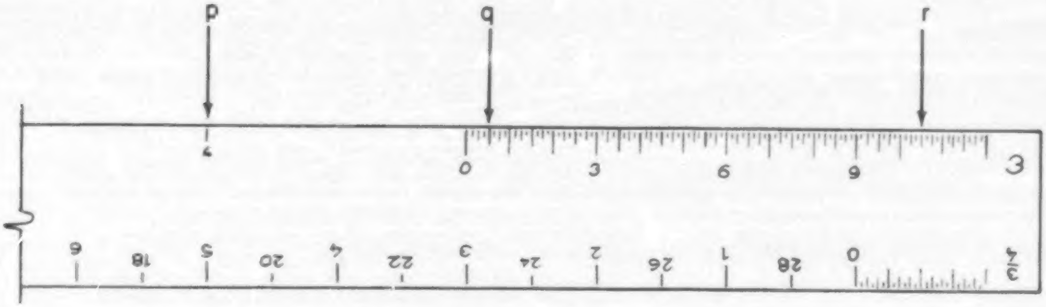
TEST


j
k
l
10
6
8
7
6
8
4
9
2
10
0
1/2
26
40
28
36
30
32
32
28
34
24
36
20
38
16
40
12
42
8
44
4
46
0
1/8

j. ______________ k. ______________ l. ______________

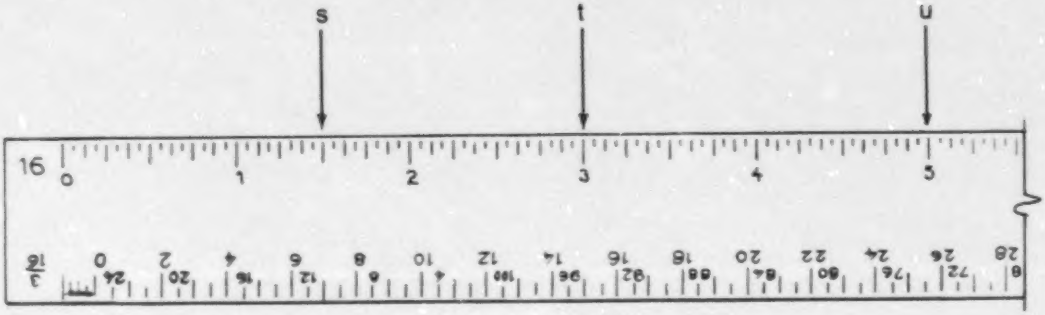

m
n
o
1 1/2
3
9
6
3
0
2
2
3/8
0
14
2
13
4
12
6
11
8
10
10
9
12
8

m. ______________ n. ______________ o. ______________


p
q
r
4
0
3
6
9
3
6
18
5
20
4
22
3
24
2
26
1
28
0
3/4

p. ______________ q. ______________ r. ______________

TEST



Scale — 12" = 1'-0"

s. ____________ t. ____________ u. ____________

(NOTE: Test questions 14 through 16 list the assignment sheets that are considered an important part of this test. If they have not been completed, check with your instructor.)

14. Read plans.

15. Interpret a finish schedule.

16. Read written specifications.

PLAN READING
UNIT III

ANSWERS TO TEST

1. a. 17
   b. 2
   c. 12
   d. 14
   e. 15
   f. 9
   g. 6
   h. 10
   i. 3
   j. 5
   k. 13
   l. 16
   m. 7
   n. 8
   o. 18
   p. 11
   q. 4
   r. 1

2. a. 3
   b. 1
   c. 5
   d. 4
   e. 6
   f. 2

3. a. Plot plan (Answer should include any four of the following)

      1) Location, dimensions, and elevation of structure on site
      2) Finished and existing grade contours
      3) Property lines and dimensions
      4) Location of utilities
      5) Location of existing conditions
      6) Location and dimensions of driveways and walks

   b. Foundation plan (Answer should include the following)

      1) Location and dimensions of footings, grade beams, foundation walls, stem walls, piers, equipment footings, foundations
      2) Location of anchor bolts (in detail view)

   c. Floor plan (Answer should include any five of the following)

      1) Outside walls, including location and dimension of all exterior openings
      2) Types of construction materials
      3) Location of interior walls and partitions
      4) Location and swing of doors
      5) Stairways
      6) Location of windows

ANSWERS TO TEST

7) Location of cabinets, electrical and mechanical equipment, fixtures
8) Location of cutting plane line

d. Elevation (Answer should include any four of the following)

1) Grade lines
2) Floor height
3) Window and door types
4) Roof lines and slope, roofing material, vents, gravei stops, projection of eaves
5) Exterior finish materials and trim
6) Exterior dimensions

e. Section (Answer should include any three of the following)

1) Details of construction and information about stairs, walls, chimneys, or other parts of construction that may not show clearly on plan
2) Floor levels in relation to grade
3) Wall thickness at various locations
4) Anchors and reinforcing steel

f. Detail (Answer should include any six of the following)

1) Footings and foundations, including anchor bolts, reinforcing, control joints
2) Beams, floor joists, bridging, other support members
3) Sills, floor framing, exterior walls, vapor barriers
4) Floor heights, thickness, expansion, reinforcing
5) Interior walls
6) Windows, exterior and interior doors, door frames
7) Roof, cornice, soffit, ceilings
8) Gravel stops, fascia, flashing
9) Fireplaces, chimneys
10) Staircases, stair assembly
11) Millwork, trim, ornamental iron, specialty items

4. a. 9
b. 1
c. 3
d. 2
e. 8
f. 7
g. 4
h. 5
i. 6

5. f Object line
e Dimension line
h Extension lines
b Hidden line
c Center line
d Cutting plane (section line)
g Break line
i Phantom line
a Leader line

ANSWERS TO TEST

6. a. Glazed clay tile
b. Brick veneer
c. Common brick
d. Concrete block
e. Glass block
f. Cut stone
g. Board insulation
h. Earth
i. Gravel
j. Concrete
k. Reinforcing bars
l. Gravel with sand
m. Loose fill insulation
n. Drywall or plaster
o. Structural steel
p. Flashing

7. a. Weatherproof switch outlet
b. Telephone jack
c. Power panel
d. Surface incandescent wall outlet
e. Push button (doorbell)
f. Kitchen ventilating fan
g. Ceiling junction box
h. Meter
i. Duplex weatherproof outlet
j. Vacuum outlet
k. Surface pendant single fluorescent fixture
l. Circuit breaker switch outlet
m. Single-pole switch outlet
n. Duplex receptacle outlet
o. Duplex grounded outlet
p. Duplex, special-purpose outlet for dishwasher
q. Ceiling fan outlet
r. Switch with pilot lamp outlet
s. Bell and buzzer combination
t. Chime

8. a. Floor register
b. Water closet (low tank)
c. Gas outlet
d. Unit heater
e. Residential double sink
f. Louver opening
g. Shower stall
h. Floor drain
i. Exhaust, return, or outside air duct section
j. Wall or space heater
k. Thermostat
l. Water heater

9. a. Center to center
b. Finished floor
c. Insulation
d. Masonry opening
e. Concrete block
f. Single-strength glass
g. Center
h. Expansion joint
i. Soil pipe
j. Terra cotta
k. Bearing plate
l. Full scale
m. Risers
n. Clean-out door
o. Double-strength glass
p. Plaster
q. Hose bibb, grade
r. Plate
s. Hardware
t. Reinforced concrete
u. Double hung, not to scale
v. Angle
w. Weep hole, on center
x. Specifications
y. Structural steel
z. Bench mark

ANSWERS TO TEST

10. a. 2
    b. 4
    c. 5
    d. 3
    e. 1
    f. 6

11. a. Avoiding disputes among builders, architects, and owners by leaving no room for misinterpretation or misunderstanding
    b. Facilitating and checking materials and workmanship during time that building is being constructed
    c. Enabling contractors to make bids based on total materials and labor required
    d. Avoiding expensive omissions when estimating costs
    e. Avoiding conflicting opinions during construction and avoiding the added costs and delays that could result

12. a. Contract
    b. Synopsis
    c. General requirements
    d. Owner's name and address
    e. Architect's name
    f. Location of structure
    g. Completion date
    h. Contractor's bid form
    i. Guarantees
    j. Insurance requirements
    k. Methods of construction
    l. Types and quality of building materials
    m. Sizes

13. a. 19/16" = 1 3/16" or 19' -0"
    b. 45/16" = 2 13/16" or 45' -0"
    c. 74/16" = 4 5/8" or 74' -0"
    d. 7/8" or 7' -0"
    e. 14/8" = 1 3/4" or 14' -0"
    f. 29/8" = 3 5/8" or 29' -0"
    g. 16/4" = 4" or 16' -0"
    h. 8/4" = 2" or 8' -0"
    i. 3/4" or 3' -0"
    j. 8/2" = 4" or 8' -0"
    k. 5/2" = 2 1/2" or 5' -0"
    l. 2/2" = 1" or 2' -0"
    m. 1 1/2" or 1' -0"
    n. 6/8" = 3/4" or 6"
    o. 3" or 2' -0"
    p. 1 1/2" or 6"
    q. 1/8" = 1/2"
    r. 21/8" = 2 5/8" or 10 1/2"
    s. 1 1/2"
    t. 3"
    u. 5"

14. Evaluated to the satisfaction of the instructor

15. Evaluated to the satisfaction of the instructor

16. Evaluated to the satisfaction of the instructor

LUMBER
UNIT IV

UNIT OBJECTIVE

After completing this unit, the student should be able to list common softwood, hardwood, and plywood grades and match common hardwoods and softwoods to their uses. The student should also be able to compute lumber quantities and write a lumber requisition. The student will show this knowledge by completing assignment sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match to their correct definitions terms associated with lumber.
2. Select from a list characteristics to consider in using lumber.
3. Match common softwoods to their correct uses.
4. Match common hardwoods to their correct uses.
5. Identify common defects in lumber.
6. Match types of softwood lumber to their correct grades.
7. Select from a list standard hardwood lumber grades.
8. Match to their correct descriptions letters designating veneers used in softwood plywood.
9. Distinguish between standard interior and exterior softwood plywood grades by face veneer.
10. Match standard hardwood plywood grades to their correct descriptions.
11. Identify types of plywood core construction.
12. Write actual sizes for given nominal sizes of softwood lumber.
13. Write actual sizes for given nominal sizes of hardwood lumber.
14. Select from a list solid softwoods used for paneling.
15. Select from a list solid hardwoods used for paneling.
16. Select from a list types of woods used for trim and moldings.

OBJECTIVE SHEET

17. Identify types of trim and moldings.

18. Match types of lumber to their correct units of measure.

19. Compute lumber quantities.

20. Write a lumber requisition.

LUMBER
UNIT IV

SUGGESTED ACTIVITIES

I. Unit contents

A. Objective sheet

B. Suggested activities

1. Supplements

a. Supplement #1 — Lumber Grading

b. Supplement #2 — Plywood Grades and Grade Trademarks

2. Transparency master: TM #1 — Clear Cutting

C. Information sheet

D. Assignment sheets

1. Assignment Sheet #1 — Compute Lumber Quantities

2. Assignment Sheet #2 — Write a Lumber Requisition

E. Answers to assignment sheets

F. Test

G. Answers to test

II. Instructor's guide

A. Obtain materials to supplement unit.

1. Films

a. *In Pursuit of Happiness,* 16mm, color/sound, 25 minutes. American Plywood Association, 1119 A Street, Tacoma, Washington 98401.

b. *In Search of the Last Redwood,* 16 mm, color/sound, 25 minutes. California Redwood Association, 1 Lombard Street, San Francisco, California 94111.

c. *Out of Sight and Underfoot,* 16 mm color/sound, 20 minutes. National Particle Board Association, 2306 Perkins Place, Silver Spring, Maryland 20910.

SUGGESTED ACTIVITIES

2. Booklets

    a. "Appalachian Oak in Fine Cabinets." Appalachian Hardwood Manufacturers, Inc., P.O. Box 427, High Point, North Carolina 27261.

    b. "Beautiful Woods." Frank Paxton Lumber Company, 6311 St. John Avenue, Kansas City, Missouri 64123.

    c. "Paxton Beautiful Woods," Index May, 1983. Frank Paxton Lumber Company, 1815 S. Agnew Avenue, P.O. Box 82215, Oklahoma City, Oklahoma 73148.

    d. "Redwood Lumber Guide." California Redwood Association, 1 Lombard Street, San Francisco, California 94111.

    e. "The Story of Particle Board." National Particle Board Association, 2306 Perkins Place, Silver Spring, Maryland 20910.

3. Transparency and competency profiles

    (NOTE: Transparency and competency profiles are available from the State Department of Vocaitonal and Technical Education, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074, or from The Associated General Contractors of America, 1957 E Street N.W., Washington, D.C. 20006; phone 202-393-2040.)

4. Samples of various lumber species and qualities

    (NOTE: Sample chips are available from most lumber companies.)

5. Samples of lumber that show different grades, sawing methods, drying methods, and surface finishes

6. Samples of paneling, trim, and molding

B. Provide students with objective sheet.

C. Discuss unit and specific objectives, explaining the importance of being able to identify different species and grades of wood.

D. Provide students with information and assignment sheets.

E. Discuss information and assignment sheets.

1. Use Information Sheet, Section I to discuss terms associated with lumber.

    SUGGESTION:

    - Show students examples to illustrate appropriate terms.

2. Use Information Sheet, Section II to discuss characteristics to consider in using lumber.

SUGGESTED ACTIVITIES

SUGGESTIONS:

- Show Transparency #1 to illustrate clear cutting.
- Use a piece of lumber to point out each of the characteristics listed.

3. Use Information Sheet, Sections III and IV to discuss the uses of common hardwoods and softwoods.

SUGGESTIONS:

- Provide students with a set of wood chips so that they may familiarize themselves with the different wood types.
- Make a game of identifying different woods. Lay out the wood chips at different stations and have students identify them. After they have identified the type of wood, have them list as many uses as possible for each type. This game could also be set up competitively, with the students divided into two teams.
- Take a field trip to a forest and allow students to make a tally of each of the different types of wood in the forest.
- Take students to a lumberyard and then to a fine furniture store so that they can compare unfinished and finished woods and see some of their uses.
- Have students survey their homes and list all the different types of wood and their uses.

4. Use Information Sheet, Section V to discuss common defects in lumber.

SUGGESTIONS:

- Show students actual examples of each defect.
- Lay out samples of lumber containing defects, and have students identify the type of defect in each.

5. Use Information Sheet, Sections VI through X to discuss the different grades and grading systems for hardwood, softwood, and plywood.

SUGGESTIONS:

- Provide students with copies of Supplements #1 and #2 to use as future reference.

SUGGESTED ACTIVITIES

- Take students on a field trip to a lumber mill or lumberyard so that they can see how the various lumber is graded.

- Lay out various grades of lumber and have students identify the grade of each piece.

6. Use Information Sheet, Section XI to discuss types of plywood core construction.

   SUGGESTION:

   - Show students samples of each type of core construction.

7. Use Information Sheet, Sections XII and XIII to discuss actual and nominal sizes of softwood and hardwood lumber.

   SUGGESTION:

   - Make a set of flashcards and have students work in teams giving actual for nominal sizes.

8. Use Information Sheet, Sections XIV through XVII to discuss softwoods and hardwoods used in paneling and to discuss various types and uses of trim and molding.

   SUGGESTIONS:

   - Show students samples of the different types of paneling, trim, and molding.

   - Have students survey their homes and list all of the types of trim, molding, and paneling used.

   - Lay out samples of the types of trim and molding listed in Section XVII. Have the students identify each type.

9. Use Information Sheet, Sections XVIII through XX to discuss units of measure, computing lumber quantities, and writing a lumber requisition.

   SUGGESTIONS:

   - Show students samples of actual lumber requisitions.

   - Have students practice computing lumber quantities by completing Assignment Sheet #1.

   - Have students write their own lumber requisition by completing Assignment Sheet #2. Then have them follow through by role-playing calling in their orders to you or to a fellow student.

F. Review all information.

SUGGESTED ACTIVITIES

G. Give test.

H. Critique test and discuss in class.

I. Complete appropriate section of competency profiles.

III. Unit references

A. *How to Specify and Buy Industrial Arts Lumber and Plywood.* Chicago, Illinois: Paxton/Patterson, Frank Paxton Lumber Company, 1981.

B. Hendrix, Laborn J. "Bud." *Commercial Carpentry.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and The Associated General Contractors of America, 1979.

C. "Labels from Wood Chips." Chicago, Illinois: Paxton/Patterson, Frank Paxton Lumber Company, n.d.

D. "Moulding Chart." Dallas, Texas: Southwest Moulding Co., n.d.

E. "Paxton Beautiful Woods." Oklahoma City, Oklahoma: Frank Paxton Lumber Company, 1983.

F. Penner, Wayman R. *Residential Carpentry.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1973.

G. *Product Use Manual.* Portland, Oregon: Western Wood Products Association, 1983.

H. Wagner, Willis H. *Modern Carpentry.* South Holland, Illinois: The Goodheart-Willcox Company, Inc., 1979.

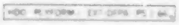
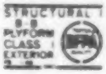
SUGGESTED ACTIVITIES

SUPPLEMENT #1 — LUMBER GRADING

	Boards	
Apperance grades Selects	B and better C select D select	Selects are used for walls, ceilings, trim, and other areas where appearance is important but the use of hardwood is not desirable because of cost or other considerations.
Finish	Superior Prime E	
Paneling	Clear (any select or finish grade) No. 2 common (selected for knotty paneling) No. 3 common (selected for knotty paneling)	
Siding (bevel, bungalow)	Superior Prime	
Boards, sheathing	No. 1 common No. 2 common No. 3 common No. 4 common	Common boards are used for shelving, decking, window trim, and other applications where appearance is less critical, or where on-site selection and cutting is practical when appearance is a consideration.
Alternate board grades	Select merchantable Construction Standard Utility	
	Dimension	
Light framing 2" to 4" thick 2" to 4" wide	Construction Standard Utility Economy	Light-framing lumber is used where great strength is *not* required, such as for studs, plates and sills.
Studs 2" to 4" thick 2" to 4" wide	Stud Economy stud	This optional all-purpose grade is limited to 10 feet in length and is suitable for all stud uses, including load-bearing walls.
Structural light framing 2" to 4" thick 2" to 4" wide	Select structural No. 1 No. 2 No. 3 Economy	Structural lumber is used for light-framing and forming where greater bending-strength is required. Typical uses include trusses, concrete pier wall forms, etc.
Structural joists and planks 2" to 4" thick 6" and wider	Select structural No. 1 No. 2 No. 3 Economy	These grades are designed especially for lumber 6 inches and wider, and are suitable for use as joists and rafters, and for general framing.
	Timbers	
Timbers	Select structural No. 1 No. 2 (No. 1 mining) No. 3 (No. 2 mining)	Timbers are used for stringers, beams, posts, and other support members.

SUGGESTED ACTIVITIES

SUPPLEMENT #2— PLYWOOD GRADES AND GRADE TRADEMARKS

Grade	Description	Grade trademark	Veneer grade	
			Faces	Inner plys
B-B Plyform, Class I and II** DFPA	Specifically manufactured for concrete forms; many reuses; smooth, solid surfaces, edge-sealed, and mill-oiled unless otherwise specified.		B	C
High-density overlaid Plyform, Class I and II** DFPA	Hard, semiopaque resin-fiber overlay, heat-fused to panel faces. Smooth surface resists abrasion. Up to two hundred reuses. Edge-sealed. Light oiling recommended between pours.		B	C Plugged
Structural I Plyform** DFPA	Especially designed for engineered applications; all Group 1 species; stronger and stiffer than Plyform, Classes I and II. Recommended for high pressures where face grain is parallel to supports. Also available with high-density overlay faces.		B	C or C Plugged
Special overlays, proprietary panels, and medium-density overlaid plywood specifically designed for concrete forming**	Produce a smooth, uniform concrete surface. Generally mill-treated with form-release agent. Check with manufacturer for design treatment recommendations for greatest number of reuses.	—	—	—

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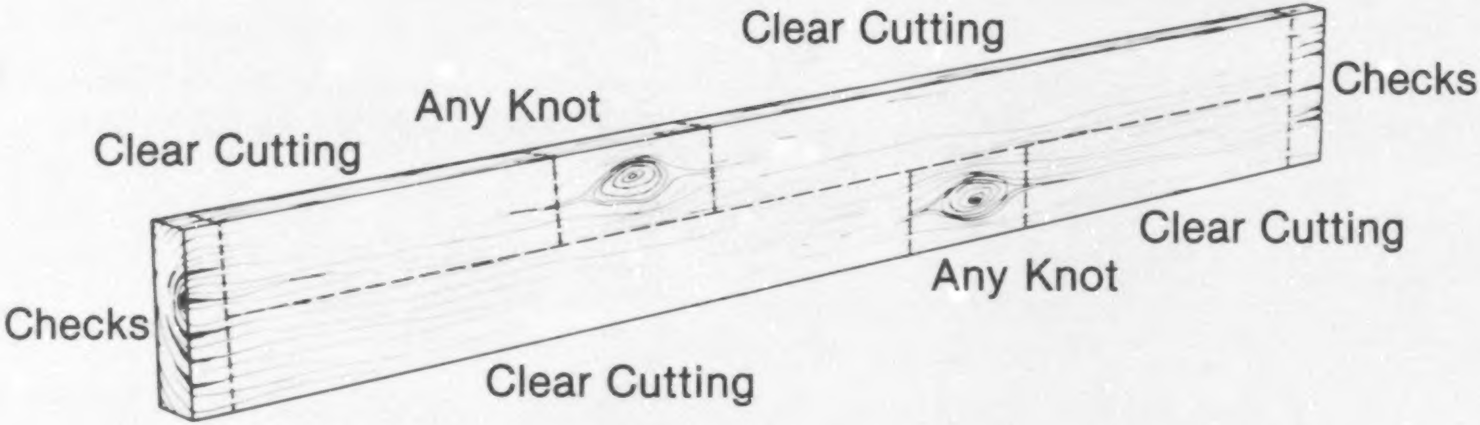
*Commonly available in ⅝-inch and ¾-inch panel thicknesses (4′ × 8′ size).
**Check dealer for availability in your area.

Clear Cutting


Clear Cutting
Checks
Any Knot
Clear Cutting
Checks
Clear Cutting
Any Knot
Clear Cutting

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LUMBER
UNIT IV

INFORMATION SHEET

I. Terms and definitions

A. Lumber — Any material, such as boards, planks, or beams, cut from timber to a size and form suitable for marketing

B. Lumber grades — Standards established by the National Grading Rule Committee and the National Hardwood Lumber Association to ensure quality lumber

C. Hardwood — Wood produced from any of the groups of trees that have broad leaves, in contrast to conifers or needle-bearing trees

(NOTE: The term *hardwood* has no reference to the actual hardness of the wood.)

D. Softwood — Wood produced from any needle- or cone-bearing trees

(NOTE: The term *softwood* has no reference to the actual softness of the wood.)

E. Plywood — Fabricated wood product constructed of three or more layers of veneer joined with glue; layers are usually at right angles to each other

F. Pulpwood — Wood ground up to make paper

G. Heartwood — Central part of tree trunk between pith and sapwood, consisting of dark, mature wood in which little further color change will occur

H. Sapwood — Light-colored wood growing between heartwood and bark

I. Veneer — Thin layer or sheet of wood glued to another base material

J. Core — Inner layers or fillers in plywood

K. Surfaced wood — Wood that has been dressed by planing to attain a smooth surface and uniform size

L. Molding — Narrow strip of wood, usually shaped to a curved profile throughout its length; used for ornamentation and to conceal surface joints

M. Kiln-dried — Dried in a heated enclosure

N. Clear cutting — Process of removing waste from boards

INFORMATION SHEET

II. Characteristics considered in using lumber

A. Kind of wood

(NOTE: Woods are classified as hard or soft, but that classification has more to do with the type of tree than the actual hardness of the wood. A builder may want to use a particular species of wood—such as redwood, cedar, or yellow pine—for a specific purpose based on the appearance or other characteristics of that type of wood.)

B. Grade

(NOTE: Lumber is graded based on its strength, appearance, number of defects, and other factors. Methods of grading are outlined by the American Lumber Standards Committee, and then detailed lists of grades and standards are developed by the various lumber producers' associations, such as Southern Pine Inspection Bureau, California Redwood Association, Western Wood Products Association, and others. Hardwood grades are regulated by the National Hardwood Lumber Association.)

C. Size

(NOTE: Lumber products come in standard sizes based on width, thickness, and length. Size may be *actual* or *nominal*. Nominal size is the size of the material before final processing and tends to be larger than the actual size after drying and shaping.)

D. Sawing method

(NOTE: Most trees are sawed so that the growth rings form an angle of less than 45 degrees with the surface of the boards produced. Such lumber is called *flat-grained* in softwoods or *plain-sawed* in hardwoods. Wood that is cut with the growth rings at an angle greater than 45 degrees is called *edge-grained* in softwoods and *quarter-sawed* in hardwoods. See Figures 1 and 2.)

EXAMPLES:

FIGURE 1

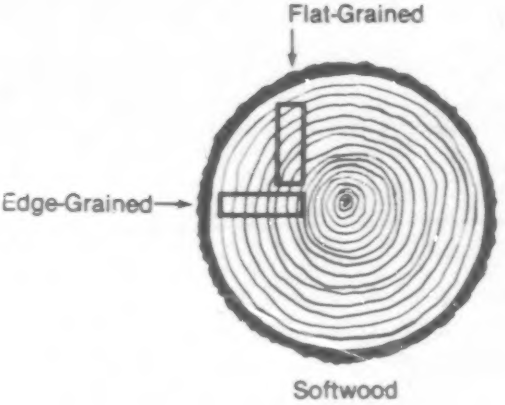
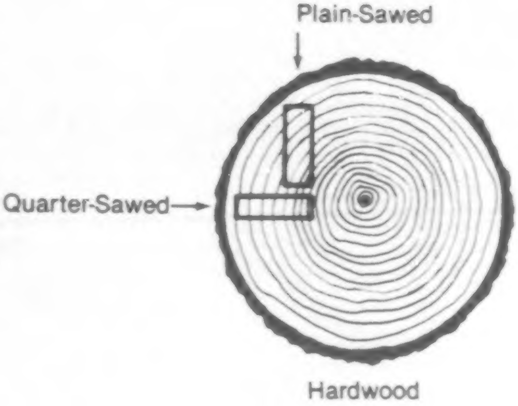


FIGURE 2



INFORMATION SHEET

E. Drying method

(NOTE: Lumber is dried to reduce its weight, to decrease shrinkage, and to improve usability. A number of considerations go into determining the correct moisture content for lumber. Generally, all the carpenter need understand is that green lumber—that is, lumber that has not been dried and with a moisture content of over 20 percent—will shrink more than air-dried or kiln-dried lumber.)

F. Surface finish

(NOTE: Lumber producers plane wood to give a smooth finish to one or more surfaces for specific purposes. Lumber may be rough, with no finished surfaces; smooth-one-side [S1S], with one wide surface planed; smooth-two-sides [S2S] with both wide surfaces planed; or smooth-four-sides [S4S] with all surfaces planed.)

III. Common softwoods and their uses

A. Aromatic red cedar and incense cedar — Chests, closet linings, pencils, fence posts, furniture, small-boat construction, novelties, paneling, interior and exterior trim, decking, greenhouse sashes and trays, railway crossties

B. Western red cedar — Shingles and shakes, lumber, poles, posts, piles, exterior siding, ship and boat building

C. Bald and pecky cypress — Millwork, planing-mill products, tanks, silos, exterior and interior trim, small boats, siding and shingles, boxes and crates, soundproof and rustic paneling, greenhouse benches

(NOTE: The pitted holes in pecky cypress make it a good material for soundproof paneling.)

D. Douglas and white fir — Construction lumber, plywood, veneers, planing-mill products, timbers, crossties, tanks, silos, trim, moldings, cabinets, flooring, doors, sashes

(NOTE: Douglas fir is one of our most valuable timber trees.)

E. Western hemlock — Millwork products such as doors and windows, utility lumber, plywood, cabinets, trim

F. Larch — Utility lumber, plywood, veneers, planing-mill products, crossties, trim, moldings, cabinets, flooring

G. Ponderosa, white, and yellow pine — Planing-mill products, cabinets, trim, molding, plywood, paneling, door panels, subflooring, sheathing, shelving, pattern lumber, models and novelties, boxes, crates, pulpwood, pallets, utility lumber

(NOTE: The pines are probably the most valuable group of timber trees in the world. They not only supply wood and pulp, but also supply natural resins including spirits of turpentine, resin, tar, and pitch.)

INFORMATION SHEET

H. Redwood — Planing-mill products, wood pipe, tanks, silos, beekeeper supplies, caskets, flumes, water towers, bridge timbers, trestles, pattern lumber, furniture, exterior siding and trim, exterior ornamentation, greenhouses, fences, plywood, paneling

(NOTE: Redwood is one of nature's outstanding wonders: Redwood trees can be destroyed by fire or felled by man or storm, but there has never been an observed case of a redwood dying from natural causes.)

I. Sitka, Engelman, white, red, and black spruce — General construction, wooden parts for aircraft, planing-mill products, plywood, cabinets, organ pipes, sounding boards for musical instruments, canoe paddles, ladder rails, decking, posts, crates, pulpwood

IV. Common hardwoods and their uses

A. Alder or red alder (fruitwood) — Utility furniture, cabinets, furniture frames, low-cost substitute for cherry

B. Northern brown ash — Furniture, cabinets, fixtures, trim, plywood

C. Southern white ash — Handles, woodenware, ball bats, implements, furniture, fixtures, cabinets, plywood, plywood edging, cabinet-door moldings

D. Basswood — Boxes, crates, planing-mill products, woodenware, moldings, picture frames, blind slats, luggage, musical instruments, matches, toys

E. Beech — Boxes, crates, planing-mill products, flooring, furniture, agricultural implements, handles, brush blocks, laundry appliances, fixtures

(NOTE: Beech is a sturdy general-purpose hardwood and is an excellent alternate for birch or hard maple.)

F. Northern birch — Planing-mill products, interior finish, trim, cabinets, furniture, plywood, veneers, shuttles, bobbins, musical instruments, dowel pins, dowel rods, screwhole buttons and plugs

G. Butternut — Furniture, interior finish, paneling, trim in boats, novelty pieces, crow and duck calls

(NOTE: It is said that butternut is unexcelled for crow and duck calls.)

H. Cherry — Fine furniture and cabinet work, plywood, paneling, veneers, screwhole buttons and plugs

I. Cottonwood — Vehicle-body construction, stair risers, general cabinet work, boxes, crates

J. American elm — Plywood, burl veneers, inexpensive furniture and fixtures

K. Sap gum and selected red gum — Furniture, millwork, cabinets, plywood, veneers, plywood core stock, boxes, crates, crating-grade plywood, miscellaneous utility purposes

INFORMATION SHEET

L. Genuine mahogany — Fine furniture, fixtures, cabinets, trim, boat work, decorative trim

(NOTE: Mahogany is internationally renowned for its extraordinary combination of beauty and utility and is regarded by many as the premier cabinet wood of the world.)

M. Philippine mahogany — Furniture, fixtures, cabinets, paneling, veneers, plywood, boats, water skis, plywood edging, screwhole buttons and plugs, flooring, trim, exterior siding

N. Hard maple — Millwork, flooring, furniture, handles, agricultural implements, shuttles, boxes, cutting surfaces, bakery paddles, inlays and overlays

(NOTE: Hard maple is one of the world's greatest general-purpose hardwoods.)

O. Red oak — Furniture, interior finish, flooring, veneers, railroad ties, agricultural implements, heavy construction, timbers, truck flooring, plywood, plywood edging, cabinet and furniture pulls and handles, screwhole buttons and plugs, dowel rods

P. White oak — Furniture, interior finish, flooring, plywood, veneers, agricultural implements, structural parts of boats and ships, fixtures, heavy construction, railroad cars, timbers, tight cooperage

Q. Pecan — Tool handles for striking and lifting, interior and exterior furniture, plywood, paneling

(NOTE: Pecan and hickory are so closely related that a NHLA inspector does not make any distinction between them.)

R. Persimmon — Recognized standard for golf-club heads, shuttles, bobbins, plane stock, decorative veneers

S. Yellow poplar — Millwork, boxes, crates, structural parts of furniture, plywood core stock, vehicles, musical instruments, trim, fixtures, siding; concrete tools such as floats, darbies, and bull floats

T. American sycamore — Interior finish, cabinet work, interior furniture parts such as drawer slides

(NOTE: Sycamore is the largest hardwood tree in the United States.)

U. American or black walnut — Home and office furniture, radio and television cabinets, interior finish, paneling, veneers, plywood, plywood edging, musical instruments, commercial fixtures, gun stocks, caskets, sewing machines, flooring, airplane propellers, clocks, carvings, trim and moldings, screwhole buttons and plugs, dowel rods

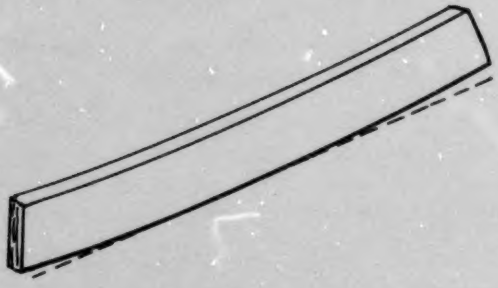
V. Common defects in lumber

A. Warps (See Figures 3-6)

INFORMATION SHEET

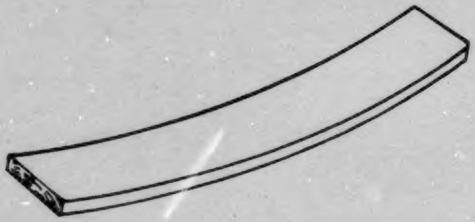
1. Crook

FIGURE 3



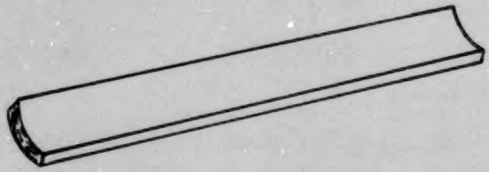
2. Bow

FIGURE 4



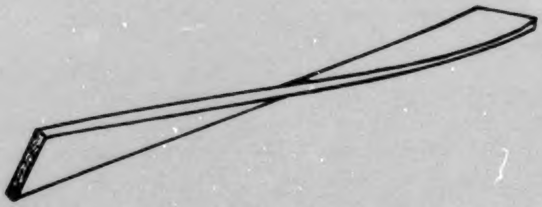
3. Cup

FIGURE 5



4. Twist or wind

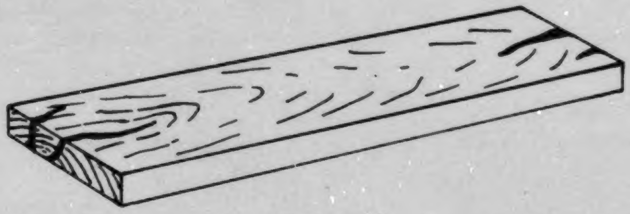
FIGURE 6



INFORMATION SHEET

B. Checks (Figure 7)

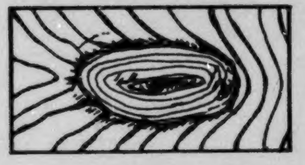
FIGURE 7



C. Knots (Figures 8-12)

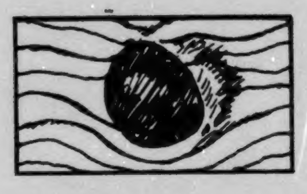
1. Intergrown

FIGURE 8



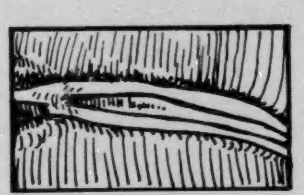
2. Encased

FIGURE 9



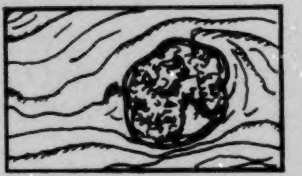
3. Spike

FIGURE 10



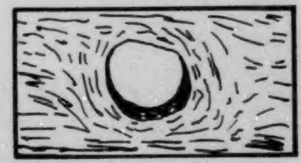
4. Decayed

FIGURE 11



5. Knothole

FIGURE 12



INFORMATION SHEET

VI. Grading of softwood lumber

(NOTE: Softwood lumber is used in shops and factories for shaped wood such as trim and molding and for on-site construction. Softwood lumber used in on-site construction is classed according to its size. *Boards* are 1 to 1½ inches thick and 2 inches or more wide. *Dimension lumber* is 2 to 5 inches thick and 2 inches or more wide. Timbers are 5 inches or more thick and 5 inches or more wide. Grades in this section are shown in descending order of quality, beginning with the best and moving to the least.)

A. Boards

1. Select
    a. B and better
    b. C select
    c. D select
2. Common
    a. No. 1 common
    b. No. 2 common
    c. No. 3 common
    d. No. 4 common

B. Dimension

1. Light-framing
    a. Construction
    b. Standard
    c. Utility
    d. Economy
2. Structural
    a. Select structural
    b. No. 1
    c. No. 2
    d. No. 3
    e. Economy

C. Timbers

1. Select structural
2. No. 1
3. No. 2 (No. 1 Mining)

VII. Standard hardwood lumber grades

A. First and second (FAS)

(NOTE: The best grade yields about 85 to 90 percent clear cuttings. Most boards are a minimum of 6 inches wide and 8 inches long. FAS lumber is graded from the poorest side.)

INFORMATION SHEET

B. First and second one face and better (FAS 1 side and better)

(NOTE: These boards are subject to the same grading rules as FAS boards, except the board is graded from the best side.)

C. Selects and better

(NOTE: These boards are subject to the same grading rules as FAS 1 side and better, except the minimum allowable width is 4 inches.)

D. Selects

(NOTE: These boards are a minimum of 4 inches wide and 6 feet long. Better side grades FAS; reverse side grades No. 1 Common. Short and narrow boards are usually clear.)

E. No. 1 common (thrift)

(NOTE: These boards are a minimum of 3 inches wide and 4 feet long. This grade yields over two-thirds clear cuttings and contains less sap than clear grades. Stock is generally long with average widths.)

VIII. Descriptions of letters designating veneers used in softwood plywood

(NOTE: Softwood plywoods are graded by their face veneers, using a system of letters to show the quality of the veneers. Each face is graded, and the plywood is then designated by the letter grades of the two face veneers, such as A-B, A-D, or C-D.)

A. N — Intended for smooth surface, natural finish; select heartwood or all sapwood free from all open defects; may contain a few repairs if well-matched

B. A — Smooth, paintable, well-jointed; permits more than eighteen neatly made boat, sled, or router-type repairs parallel to grain

C. B — Relatively smooth; permits circular repair plugs and small tight knots to 1 inch; wood or synthetic patching material may be used; some minor splits are permitted

D. C — Tight knots to 1½ inches; permits knotholes to 1 inch and some to 1½ inches if total width is within specified limits; synthetic or wood repairs are permitted; limited splits are allowed

E. C (plugged) — Improved C veneer with splits limited to ⅛-inch wide and knotholes and borer holes limited to ¼" × ½"; synthetic repairs are permitted

F. D — Permits knots and knotholes to 2½ inches in width and ½ inch larger under certain specified limits; limited splits are permitted

INFORMATION SHEET

IX. Standard softwood plywood grades (Table 1)

(NOTE: Softwood plywoods are classed as interior [INT] or exterior [EXT]. Interior plywoods are made with a moisture-resistant glue, while exterior plywoods are made with a waterproof glue.)

TABLE 1

Standard softwood plywood grades (by face veneer)

Interior	Exterior
A-A	A-A
A-B	A-B
A-D	A-C
B-B	B-B
B-D	B-C
C-D	C-D
APA Plyform	B-B Plyform
	HDO Plyform

X. Descriptions of standard hardwood plywood grades

(NOTE: The outer plies of plywood are called the *face* and *back*, the next plies or layers are called *crossbands*, and the inside plies or the centers are called *cores*.)

A. A — Premium

B. A1 — Premium one side, sound back; back has light, uniform color and grain; can be mismatched

C. A2 — Premium one side, sound back; back is free of open defects; can be mismatched and of a different species

D. G1S — Good one side, reject back; back has knotholes

E. G2S — Good both sides

F. Craft shop — Sound utility face and back, reasonably well matched in color

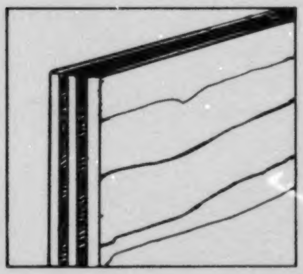
G. Shop utility — Sound face; American-made unless specified otherwise; all grades with softwood core may have small cracks in core where individual pieces of veneer edge do not meet perfectly

INFORMATION SHEET

XI. Types of plywood core construction (Figures 13-16)

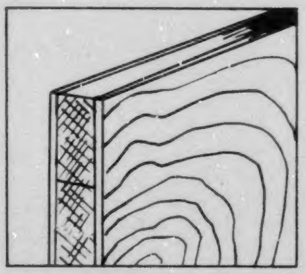
A. Veneer core

FIGURE 13



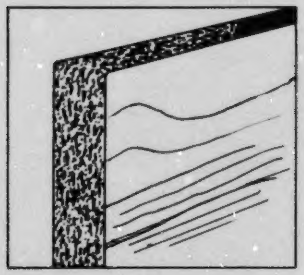
B. Lumber core

FIGURE 14



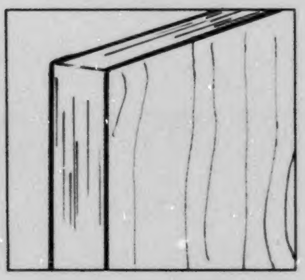
C. Particle-board core

FIGURE 15



D. Fiberboard core

FIGURE 16



XII. Nominal and actual softwood lumber sizes (See Table 2)

(NOTE: The sizes given in Table 2 are the most common widths and thicknesses of softwood lumber. Standard lengths come in 2-foot increments beginning with 8 feet and going up to 24 feet—that is, 8′, 10′, 12′, 14′, 16′, 18′, 20′, 22′, and 24′. Most suppliers can special-order lengths over 24 feet. Length is generally an actual measurement.)

INFORMATION SHEET

TABLE 2

Nominal and actual softwood lumber sizes

Nominal (rough)	Actual (S4S)
1" × 4"	3/4" × 3 1/2"
1" × 6"	3/4" × 5 1/2"
1" × 8"	3/4" × 7 1/4"
1" × 10"	3/4" × 9 1/4"
1" × 12"	3/4" × 11 1/4"
2" × 4"	1 1/2" × 3 1/2"
2" × 6"	1 1/2" × 5 1/2"
2" × 8"	1 1/2" × 7 1/4"
2" × 10"	1 1/2" × 9 1/4"
2" × 12"	1 1/2" × 11 1/4
4" × 4"	3 1/2" × 3 1/2"
4" × 6"	3 1/2" × 5 1/2"

XIII. Nominal and actual hardwood lumber sizes (Table 3)

TABLE 3

Nominal and actual hardwood lumber sizes

Nominal (rough)	Actual (S2S) plain	Actual (S2S) quartered
1/2"	5/16"	5/16"
5/8"	7/16"	7/16"
3/4"	9/16"	9/16"
1"	25/32"	25/32"
1 1/4"	1 1/16"	1 1/32"
1 1/2"	1 5/16	1 9/32"
2"	1 3/4"	1 11/16"
2 1/2"	2 1/4"	2 1/4"
3"	2 3/4"	2 3/4"
4"	3 3/4"	3 3/4"

INFORMATION SHEET

XIV. Solid softwoods used for paneling

A. Cedar
B. Cypress
C. Hemlock
D. Pine
E. Redwood
F. Spruce

XV. Solid hardwoods used for paneling

A. Ash
B. Cherry
C. Chestnut
D. Mahogany
E. Oak
F. Pecan
G. Poplar
H. Sycamore
I. Walnut

XVI. Types of wood used for trim and moldings

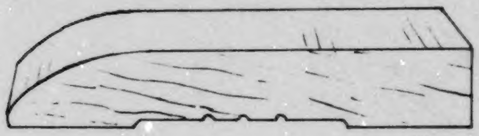
A. Ash
B. Basswood
C. Birch
D. Cypress
E. Mahogany
F. Oak
G. Pecan
H. Redwood
I. Walnut
J. White pine

XVII. Types and sizes of trim and moldings (Figures 13-30)

(NOTE: Trim is the finish material in a building, such as that applied around window and door openings or at the floor and ceiling of rooms.)

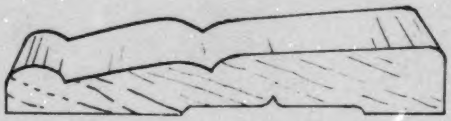
A. Base

FIGURE 13



1/2" x 3 1/8"

FIGURE 14



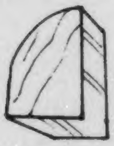
1/2" x 3"

Figures 13 and 14 used with permission of Southwest Moulding Company, Dallas, Texas.

INFORMATION SHEET

B. Base shoe

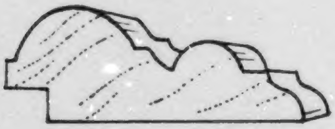
FIGURE 15



1/2" × 3/4"

C. Cap molding (cap strip)

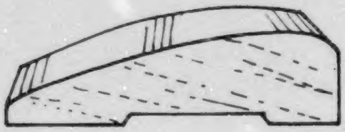
FIGURE 16



13/16" × 2 1/8"

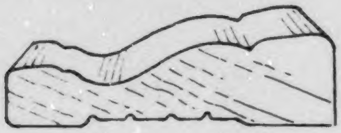
D. Casing

FIGURE 17



5/8" × 2 1/4"

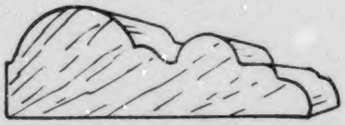
FIGURE 18



5/8" × 2 1/4"

E. Chair rail

FIGURE 19

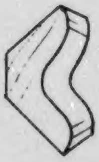


13/16" × 2 1/8"

F. Corner

1. Inside

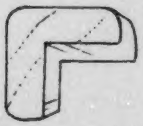
FIGURE 20



3/4" × 3/4"

2. Outside

FIGURE 21



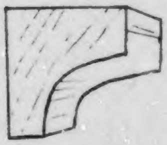
3/4" × 3/4"

Figures 15-21 used with permission of Southwest Moulding Company, Dallas, Texas.

INFORMATION SHEET

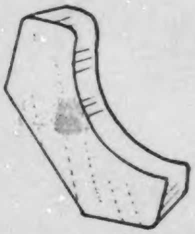
G. Cove

FIGURE 22



3/4" x 7/8"

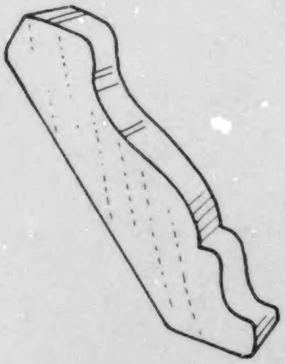
FIGURE 23



9/16" x 1 3/4"

H. Crown

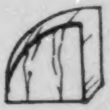
FIGURE 24



9/16" x 2 3/4"

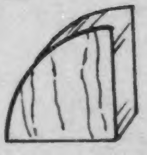
I. Quarter round

FIGURE 25



1/2" x 1/2"

FIGURE 26



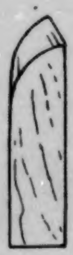
3/4" x 3/4"

Figures 22-26 used with permission of Southwest Moulding Company, Dallas, Texas.

INFORMATION SHEET

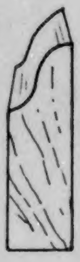
J. Stop

FIGURE 27



3/8" x 1 3/8"

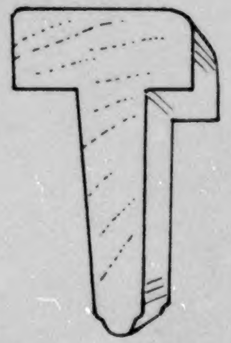
FIGURE 28



7/16" x 1 3/8"

K. T-astragal

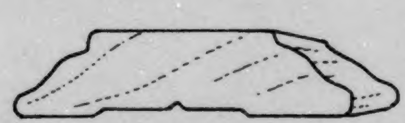
FIGURE 29



1 3/4" x 7"

L. Wainscot cap or batten

FIGURE 30



9/16" x 2 1/4"

Figures 27-30 used with permission of Southwest Moulding Company, Dallas, Texas.

XVIII. Units of measurement for various types of lumber

(NOTE: Lumber and certain related building materials come in basically three different units of measurement, each unit serving as the basis for pricing such materials. For example, 2×4 studs may cost 28 cents a board foot, plywood may cost 22 cents a square foot, and molding may sell for 18 cents a lineal foot. Also, lumber suppliers often give discounts for large-quantity orders. For instance, they may have one price per board foot and a lower price for 100 board feet [C bd. ft.] or per 1000 board feet [M bd. ft.].)

A. Board foot — Boards, dimension lumber, structural lumber, shop and factory lumber

INFORMATION SHEET

B. Square foot — Plywood, particle board, drywall, sheathing, paneling, and certain hardwoods, milled boards, and speciality products such as flooring and ceiling tile

C. Lineal foot — Molding and trim

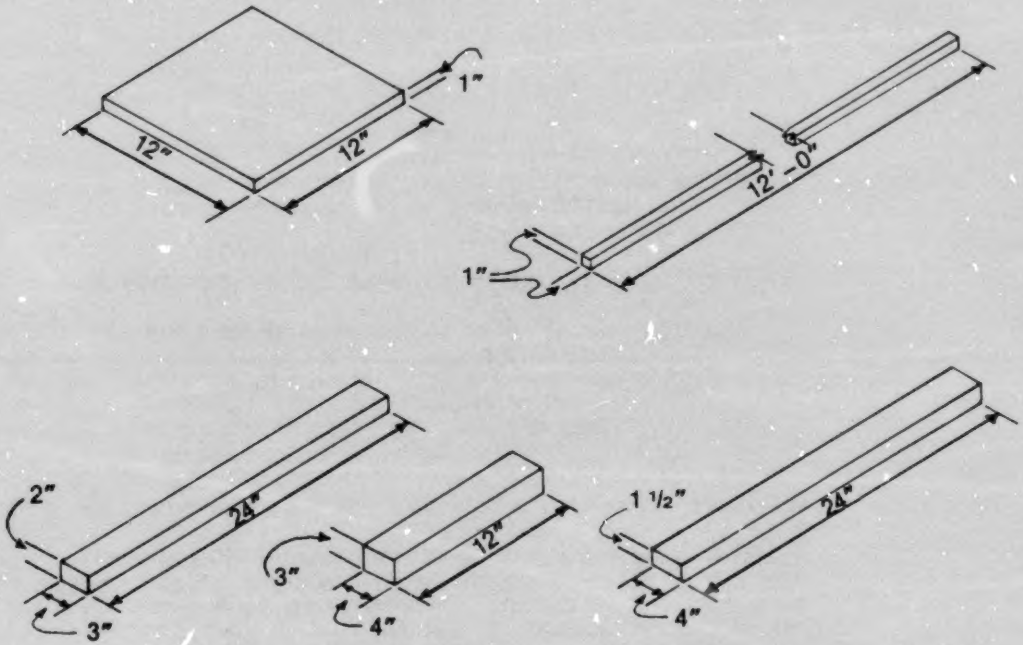
XIX. Computing lumber quantities

A. Board feet

(NOTE: A board foot is 1 inch thick, 12 inches wide, and 1 foot long, or the equivalent. Each of the illustrations in Figure 31 is 1 board foot.)

EXAMPLE:

FIGURE 31



1. Use formula $\frac{N \times T \times W \times L}{12}$, where N is number of pieces, T is thickness in inches, W is width in inches, and L is length in feet

INFORMATION SHEET

2. Use nominal sizes in figuring board feet, except for lumber less than 1 inch thick, which is figured as 1 inch

   EXAMPLE: A piece 1/2" × 12" × 12" is considered to be 1 board foot.

3. Round fractional board feet to next full board foot

   EXAMPLES: 1 1/3 board feet is rounded to 2 board feet.

   1 1/2 board feet is rounded to 2 board feet.

   1 3/4 board feet is rounded to 2 board feet.

   1/2 board foot is rounded to 1 board foot.

B. Square feet

(NOTE: A square foot is an area equal to a square with 12-inch sides.)

1. Use the formula A = W × L, where A is area, W is width, and L is length

   EXAMPLE: To figure the square footage in a 4′ × 8′ sheet of plywood—

   A = W × L

   = 4′ × 8′

   = 32 square feet

2. To find number of units needed (sheets, tiles, pieces, etc.), divide number of square feet to be covered by total square feet in one unit in which material is sold

3. Round fractional units to next whole unit in which material is sold

   EXAMPLE: To figure the plywood decking for a roof 20′−0″ × 41′−0″, use the formula A = W × L to get 280 total square feet to be covered. Divide this number by 32 (total square feet in one sheet of plywood) to get 25 5/8. Round this fractional unit to 26. Order twenty-six sheets of plywood to cover the area with no allowance for waste.

C. Lineal feet — Measure the distance in which the required product will be used

(NOTE: Molding and trim are sold in standard lengths of even-foot measurements. Most suppliers mix the lengths to get as close as possible to the amount ordered. For example, a supplier would probably ship 108 or 110 feet of base if an order called for 107 feet. The buyer is charged for the amount delivered, not for the amount ordered.)

XX. Writing a lumber requisition

A. Amount — Specify either as number of pieces or as quantity

EXAMPLES: 200 board feet of 1" × 12" white pine; 36 sheets of 1/2" C-D plywood; 150 feet of sanitary base

INFORMATION SHEET

B. Size

1. For boards, dimension, and structural lumber, specify thickness, width, and length
2. For plywoods, paneling, and some other sheet products such as lumber core ash, specify thickness
3. For most trim and molding, specify thickness and width
4. When actual size of product is different from nominal size, use nominal size when ordering

C. Grade — Specify according to industry grading standards

D. Type of wood — Specify if a particular species is required

(NOTE: For most light framing, suppliers stock only one or two kinds of wood, such as Douglas fir or western hemlock. Often the order will not specify the species for such uses.)

E. Drying — Specify if moisture content is a concern

(NOTE: Most lumber is kiln-dried [KD], and most orders will not specify drying unless something other than KD is desired or if the desired moisture content is different from what is normally stocked for that type of lumber.)

F. Cut and surfacing — Specify if edge-grained or quarter-sawed cut is desired or if surface finishes other than what is normal for type of lumber are desired

G. Special requirements — Specify if special characteristics of the lumber are required, or if the supplier is to prepare the lumber in a special way (Table 4)

EXAMPLE:

TABLE 4

Special requirements

Amount	Size	Description
6	2" × 4" × 14'	Utility, fir, KD
31 sheets	1/2"	C-D, fir
10 sheets	5/8"	B-B, Plyform
110"	1/2" × 3 1/8"	#1 sanitary base, ash
200 Bd ft	2" × 6"	Construction, redwood, hand select

LUMBER
UNIT IV

ASSIGNMENT SHEET #1 — COMPUTE LUMBER QUANTITIES

NAME ______________________________ SCORE ______________

In order to write accurate lumber requisitions, a carpenter must be skilled in computing lumber quantities. Practice computing total board feet, square feet, and lineal feet by completing this assignment sheet. Refer to Information Sheet, Section XIX if necessary.

PART I

Compute total board feet for each of the following problems. Round fractional board feet to the next full board foot. Write your answers in the spaces provided.

A. One common board 1" × 10" × 10' = ____________________

B. One select board 1" × 4" × 14' = ____________________

C. One piece of light-framing dimension lumber 2" × 6" × 8' = ____________________

D. One piece of structural dimension lumber 2" × 8" × 10' = ____________________

E. Two select boards 2" × 6" × 8' = ____________________

F. Five common boards 1" × 8" × 8' = ____________________

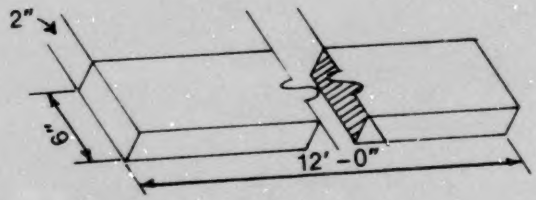
G. Ten pieces of structural dimension lumber 4" × 6" × 10' = ____________________

H. One piece of light-framing dimension lumber 2" × 4" × 18' = ____________________

I. One hundred timbers 5" × 12" × 24' = ____________________

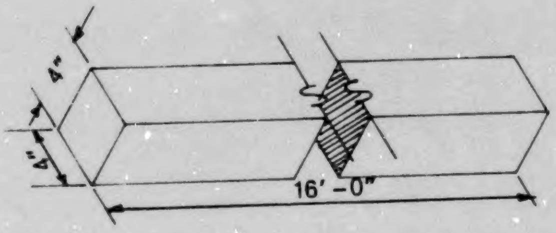
J. Thirty common boards at 1" × 2" × 6' = ____________________

K. Compute board feet for each of the pieces of lumber in the following illustrations.

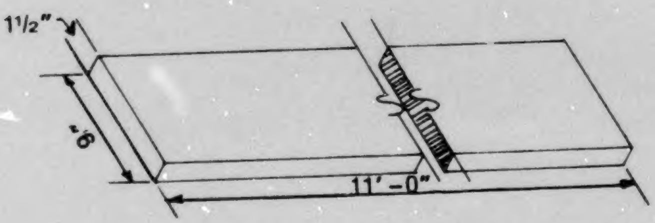


1. ____________________ board feet

ASSIGNMENT SHEET #1



2. ____________________ board feet



3. ____________________ board feet

PART II

Compute square feet and determine the number of sheets needed to cover each of the following surface areas with the material listed below them. Plywood comes in 32-square-foot sheets, gyplap in 16-square-foot sheets. Remember to round fractional sheets to the next whole sheet.

A. Area 11' -6" x 9' -10" = ____________________ square feet
(Gyplap)
____________________ sheets

B. Area 24' -0" x 13' -0" = ____________________ square feet
(Plywood)
____________________ sheets

C. Area 46' -0" x 38' -0" = ____________________ square feet
(Plywood)
____________________ sheets

D. Area 15' -0" x 18' -0" = ____________________ square feet
(Plywood)
____________________ sheets

ASSIGNMENT SHEET #1

E. Area 32′ – 0″ × 12′ – 0″ = ____________________ square feet
(Gyplap)
____________________ sheets

PART III

Figure lineal feet for each of the following problems.

A. Eight pieces of base 12-feet long = ____________________ lineal feet

B. Forty-two pieces of molding 16-feet long = ____________________ lineal feet

C. Measure the base on the north and west walls of your shop or classroom. Write the number of lineal feet of molding or trim needed to cover this area.

Lineal feet of molding or trim = ____________________

LUMBER
UNIT IV

ASSIGNMENT SHEET #2 — WRITE A LUMBER REQUISITION

NAME ____________________________________ SCORE ________________

A carpenter must be sure that lumber is appropriate for its intended use. It must be the correct kind of wood, the most economical grade to suit the purpose, the right size, and it must be properly cut and dried. All of these characteristics, as well as the quantity required, must be specified when ordering lumber.

Use the form on the next page to write a requisition for the materials required for each situation described below. Refer to the information sheet or other texts for additional information, or consult with a local materials supplier. Answers and materials selected will vary. Be prepared to discuss your choices and your reasons for these choices.

A. Order the plywood required to deck a 2000-square-foot roof.

B. Order the material needed to build the decking for a rot-resistant deck, 10′ –0″ × 14′ –0″.

C. Order cove molding for two rooms 18′ × 12′ and for one room 22′ × 16′.

D. Order birch material for cabinet doors. You need enough for fifteen 12″ × 24″ doors.

E. Order a rot-resistant rough-surface material for use on the gable of a house. You need enough to cover 144 square feet.

F. Order studs for energy-efficient walls. You will need 146 studs $92\frac{5}{8}$ inches long.

G. Order material for 12-inch deep wood shelves to be used in 6-foot-wide closets. You need enough for eight closets. There is one shelf per closet.

H. Order material for ceiling joists. The material needs to span a house 28′ –0″ wide with a load-bearing wall at 14′ –0″. You need enough material to have a joist every 16 inches for a run of 46′ –0″. Allow the joists to overlap 24 inches at the load-bearing wall.

I. Order material to line a wardrobe closet to protect the clothing from mildew and moths. The material should have a pleasing appearance. You will need enough to cover 320 square feet.

J. Order material to lay the sole plate of a building built with 2×4 walls. The material should be treated. You will need enough to go around a 24′ –0″ × 48′ –0″ building.

ASSIGNMENT SHEET #2

Amount	Size	Description
A. ________	________	________
B. ________	________	________
C. ________	________	________
D. ________	________	________
E. ________	________	________
F. ________	________	________
G. ________	________	________
H. ________	________	________
I. ________	________	________
J. ________	________	________

LUMBER
UNIT IV

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

Part I

A. 9 board feet
B. 5 board feet
C. 8 board feet
D. 14 board feet
E. 16 board feet
F. 27 board feet
G. 200 board feet
H. 12 board feet
I. 12,000 board feet
J. 30 board feet
K.
  1. 12 board feet
  2. 22 board feet
  3. 13 board feet

Part II

A. 115 square feet; 8 sheets
B. 312 square feet; 10 sheets
C. 1748 square feet; 55 sheets
D. 278 square feet; 9 sheets
E. 384 square feet; 24 sheets

Part III

A. 96 lineal feet
B. 672 lineal feet
C. Evaluated to the satisfaction of the instructor

Assignment Sheet #2

(NOTE: The answers given are typical orders for each situation and make no allowance for waste. However, your students may have different answers that are acceptable if they chose different materials or laid out the materials differently. Material selections may reflect various construction techniques or the availability of materials in your area. By discussing their choices and the reasons for those choices, your students will develop a greater understanding of lumber grades, dimensions, and applications.)

Amount	Size	Description
A. 63 sheets	4′ × 8′ × 1/2″	C-D plywood
B. 42	2″ × 4″ × 10′	Construction grade redwood, selected for minimum crown
C. 196 lineal feet	3/4″ × 7/8″	Ash cove molding
D. 1 sheet	4′ × 8′ × 3/4″	Birch, fibercore plywood
E. 144 board feet	1″ × 12″	#2 rough cedar
F. 146	2″ × 6″ × 92 5/8″	Utility studs
G. 4	1″ × 12″ × 12′	#2 white pine
H. 72	2″ × 6″ × 16′	Utility, Douglas fir
I. 640 lineal feet	1″ × 6″	Tongue-and-groove cedar, select
J. 9	2″ × 4″ × 16′	Utility, Douglas fir, treated

LUMBER
UNIT IV

TEST

NAME ______________________________ SCORE ______________

1. Match to their correct definitions terms associated with lumber. Write the correct numbers in the blanks.

______a. Standards established by the National Grading Rule Committee and the National Hardwood Lumber Association to ensure quality lumber

______b. Wood that has been dressed by planing to attain a smooth surface and uniform size

______c. Narrow strip of wood, usually shaped to a curved profile throughout its length; used for ornamentation and to conceal surface joints

______d. Process of removing waste from boards

______e. Any material, such as boards, planks, or beams, cut from timber to a size and form suitable for marketing

______f. Wood produced from any of the groups of trees that have broad leaves, in contrast to conifers or needle-bearing trees

______g. Light-colored wood growing between heartwood and bark

______h. Inner layers or fillers in plywood

______i. Fabricated wood product constructed of three or more layers of veneer joined with glue; layers are usually at right angles to each other

______j. Thin layer or sheet of wood glued to another base material

______k. Wood ground up to make paper

______l. Central part of tree trunk between pith and sapwood, consisting of dark, mature wood in which little further color change will occur

______m. Wood produced from any needle- or cone-bearing trees

______n. Dried in a heated enclosure

1. Surfaced wood
2. Veneer
3. Lumber
4. Kiln-dried
5. Lumber grades
6. Plywood
7. Pulpwood
8. Softwood
9. Clear cutting
10. Heartwood
11. Core
12. Hardwood
13. Molding
14. Sapwood

TEST

2. Select from the following list characteristics to consider in using lumber. Write an "X" in the blank before each correct answer.

_____a. Brand name

_____b. Sawing method

_____c. Grade

_____d. Drying method

_____e. Kind of wood

_____f. Price

_____g. Size

_____h. Core finish

_____i. Surface finish

3. Match common softwoods to their correct uses. Write the correct numbers in the blanks. Uses continue on the next page.

_____a. Chests, closet linings, pencils, fence posts, furniture, small-boat construction, novelties, paneling, interior and exterior trim, decking, greenhouse sashes and trays, railway crossties

_____b. Construction lumber, plywood, veneers, planing-mill products, timbers, crossties, tanks, silos, trim, moldings, cabinets, flooring, doors, sashes

_____c. Utility lumber, plywood, veneers, planing-mill products, crossties, trim, moldings, cabinets, flooring

_____d. Planing-mill products, wood pipe, tanks, silos, beekeeper supplies, caskets, flumes, water towers, bridge timbers, trestles, pattern lumber, furniture, exterior siding and trim, exterior ornamentation, greenhouses, fences, plywood, paneling

_____e. Millwork, planing-mill products, tanks, silos, exterior and interior trim, small boats, siding and shingles, boxes and crates, soundproof and rustic paneling, greenhouse benches

_____f. Millwork products such as doors and windows, utility lumber, plywood, cabinets, trim

1. Larch
2. Bald and pecky cypress
3. Sitka, Engelman, white, red, and black spruce
4. Douglas and white fir
5. Western hemlock
6. Aromatic red cedar and incense cedar
7. Ponderosa, white, and yellow pine
8. Redwood
9. Western red cedar

TEST

______g. Planing-mill products, cabinets, trim, molding, plywood, paneling, door panels, subflooring, sheathing, shelving, pattern lumber, models and novelties, boxes, crates, pulpwood, pallets, utility lumber

______h. General construction, wooden parts for aircraft, planing-mill products, plywood, cabinets, organ pipes, sounding boards for musical instruments, canoe paddles, ladder rails, decking, posts, crates, pulpwood

______i. Shingles and shakes, lumber, poles, posts, piles, exterior siding, ship and boat building

4. Match common hardwoods to their correct uses. Write the correct numbers in the blanks.

Part one

______a. Fine furniture and cabinet work, plywood, paneling, veneers, screwhole buttons and plugs

______b. Boxes, crates, planing-mill products, woodenware, moldings, picture frames, blind slats, luggage, musical instruments, matches, toys

______c. Plywood, burl veneers, inexpensive furniture and fixtures

______d. Furniture, cabinets, fixtures, trim, plywood

______e. Furniture, interior finish, paneling, trim in boats, novelty pieces, crow and duck calls

______f. Utility furniture, cabinets, furniture frames, low-cost substitute for cherry

______g. Vehicle-body construction, stair risers, general cabinet work, boxes, crates

______h. Handles, woodenware, ball bats, implements, furniture, fixtures, cabinets, plywood, plywood edging, and cabinet-door moldings

______i. Planing-mill products, interior finish, trim, cabinets, furniture, plywood, veneers, shuttles, bobbins, musical instruments, dowel pins, dowel rods, screwhole buttons and plugs

______j. Boxes, crates, planing-mill products, flooring, furniture, agricultural implements, handles, brush blocks, laundry appliances, fixtures

1. Butternut
2. Cottonwood
3. Southern white ash
4. American elm
5. Northern brown ash
6. Northern birch
7. Basswood
8. Beech
9. Alder or red alder (fruitwood)
10. Cherry

TEST

Part two

_____a. Tool handles for striking and lifting, interior and exterior furniture, plywood, paneling

_____b. Furniture, interior finish, flooring, veneers, railroad ties, agricultural implements, heavy construction, timbers, truck flooring, plywood, plywood edging, cabinet and furniture pulls and handles, screwhole buttons and plugs, dowel rods

_____c. Recognized standard for golf-club heads, shuttles, bobbins, plane stock, decorative veneers

_____d. Fine furniture, fixtures, cabinets, trim, boat work, decorative trim

_____e. Furniture, millwork, cabinets, plywood, veneers, plywood core stock, boxes, crates, crating-grade plywood, miscellaneous utility purposes

_____f. Home and office furniture, radio and television cabinets, interior finish, paneling, veneers, plywood, plywood edging, musical instruments, commercial fixtures, gun stocks, caskets, sewing machines, flooring, airplane propellers, clocks, carvings, trim and moldings, screwhole buttons and plugs, dowel rods

_____g. Interior finish, cabinet work, interior furniture parts such as drawer slides

_____h. Furniture, interior finish, flooring, plywood, veneers, agricultural implements, structural parts of boats and ships, fixtures, heavy construction, railroad cars, timbers, tight cooperage

_____i. Millwork, flooring, furniture, handles, agricultural implements, shuttles, boxes, cutting surfaces, bakery paddles, inlays and overlays

_____j. Furniture, fixtures, cabinets, paneling, veneers, plywood, boats, water skis, plywood edging, screwhole buttons and plugs, flooring, trim, exterior siding

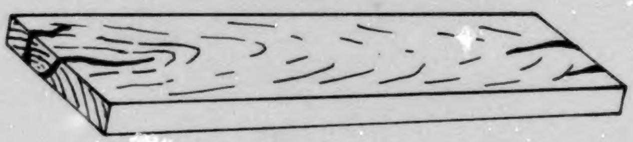
_____k. Millwork, boxes, crates, structural parts of furniture, plywood core stock, vehicles, musical instruments, trim, fixtures, siding; concrete tools such as floats, darbies, and bull floats

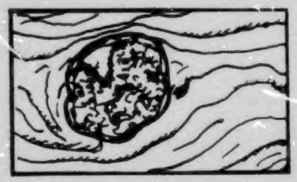
1. Persimmon
2. American or black walnut
3. White oak
4. Pecan
5. Yellow poplar
6. Genuine mahogany
7. Hard maple
8. American sycamore
9. Red oak
10. Sap gum and selected red gum
11. Philippine mahogany

TEST

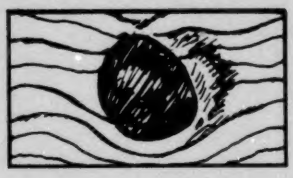
5. Identify common defects in the lumber illustrated. Write the correct names in the blanks. Illustrations continue on the next page.

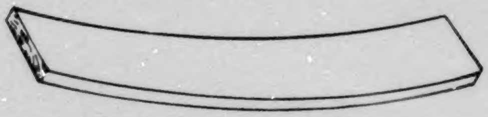
Crook warp
Bow warp
Cup warp
Twist or wind warp
Checks
intergrown knot
Encased knot
Spike knot
Decayed knot
Knothole



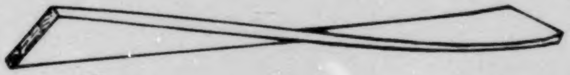


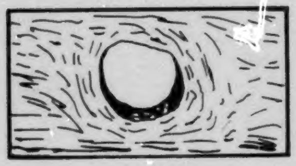
a. ______________________________ b. ______________________________



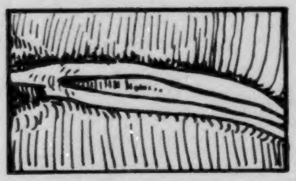


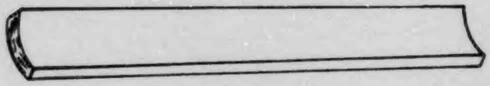
c. ______________________________ d. ______________________________





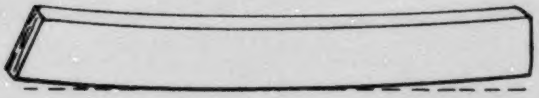
e. ______________________________ f. ______________________________

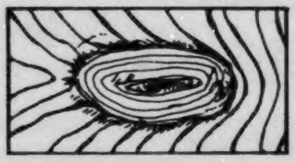




g. ______________________________ h. ______________________________

TEST





i. ______________________________ j. ______________________________

6. Match types of softwood lumber to their correct grades. Write the correct numbers in the blanks.

______ a. Construction
Standard
Utility
Economy

______ b. No. 1 common
No. 2 common
No. 3 common
No. 4 common

______ c. B and better
C select
D select

______ d. Select structural
No. 1
No. 2
No. 3
Economy

______ e. Select structural
No. 1
No. 2 (No. 1 Mining)

1. Timbers
2. Light-framing dimension
3. Select boards
4. Structural dimension
5. Common boards

7. Select from the following list standard hardwood lumber grades. Write an "X" in the blank before each correct answer.

______ a. Selects

______ b. First and third (S4S)

______ c. No. 1 common (thrift)

______ d. First and second one face and better (FAS 1 side and better)

______ e. Premium (FAS, S2S)

______ f. Selects and better

______ g. First and second (FAS)

TEST

8. Match to their correct descriptions letters designating veneers used in softwood plywood. Write the correct numbers in the blanks.

_____a. Relatively smooth; permits circular repair plugs and small tight knots to 1 inch; wood or synthetic patching material may be used; some minor splits are permitted

_____b. Intended for smooth surface, natural finish; select heartwood or all sapwood free from all open defects; may contain a few repairs if well-matched

_____c. Permits knots and knotholes to 2½ inches in width and ½ inch larger under certain specified limits; limited splits are permitted

_____d. Improved C veneer with splits limited to ⅛-inch wide and knotholes and borer holes limited to ¼" × ½"; synthetic repairs are permitted

_____e. Smooth, paintable, well-jointed; permits more than eighteen neatly made boat, sled, or router-type repairs, parallel to grain

_____f. Tight knots to 1½ inches; permits knotholes to 1 inch and some to 1½ inches if total width is within specified limits; synthetic or wood repairs are permitted; limited splits are allowed

1. N
2. A
3. B
4. C
5. C (plugged)
6. D

9. Distinguish between standard interior and exterior softwood plywood grades by face veneer. Write an "I" in the blanks before interior grades, and an "E" in the blanks before exterior grades. Some blanks may contain more than one answer.

__________a. A-A

__________b. C-D

__________c. B-B Plyform

__________d. A-B

__________e. B-C

__________f. A-D

__________g. APA Plyform

__________h. A-C

__________i. B-D

__________j. HDO Plyform

__________k. B-B

TEST

10. Match standard hardwood plywood grades to their correct descriptions. Write the correct numbers in the blanks.

______a. Good both sides

______b. Sound face; American-made unless specified otherwise; all grades with softwood core may have small cracks in core where individual pieces of veneer edge do not meet perfectly

______c. Premium

______d. Premium one side, sound back; back is free of open defects; can be mismatched and of a different species

______e. Good one side, reject back; back has knotholes

______f. Premium one side, sound back; back has light, uniform color and grain; can be mismatched

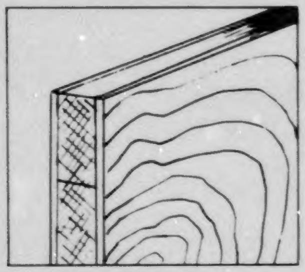
______g. Sound utility face and back, reasonably well matched in color

1. A
2. A1
3. A2
4. G1S
5. G2S
6. Craft shop
7. Shop utility

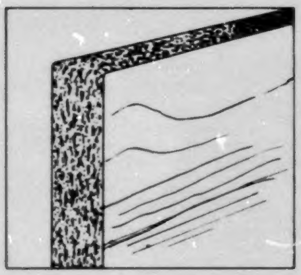
11. Identify the following illustrations of types of plywood core construction. Write the correct names in the blanks. Illustrations continue on the next page.

Veneer core
Lumber core

Particle-board core
Fiberboard core

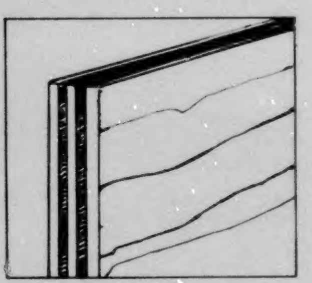


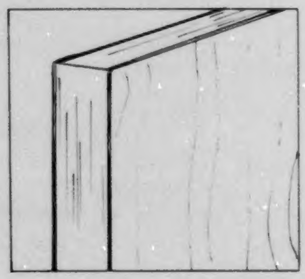
a. ______________________________



b. ______________________________

TEST





c. ______________________ d. ______________________

12. Write actual sizes for given nominal sizes of softwood lumber.

Actual (S4S)	Nominal (rough)
a. ______________	1″ × 4″
b. ______________	1″ × 6″
c. ______________	1″ × 12″
d. ______________	2″ × 4″
e. ______________	2″ × 6″
f. ______________	2″ × 8″
g. ______________	2″ × 10″
h. ______________	4″ × 6″

13. Write actual sizes for given nominal sizes of hardwood lumber.

Nominal (rough)	Actual (S2S) plain	Actual (S2S) quartered
1/2″	5/16″	a. ______________
3/4″	b. ______________	9/16″
1 1/4″	c. ______________	1 1/32″
1 1/2″	d. ______________	e. ______________
3″	f. ______________	2 3/4″
4″	3 3/4″	g. ______________

TEST

14. Select from the following list solid softwoods used for paneling. Write an "X" in the blank before each correct answer.

______a. Pine

______b. Redwood

______c. Spruce

______d. Cedar

______e. Basswood

______f. Hemlock

______g. Cypress

15. Select from the following list solid hardwoods used for paneling. Write an "X" in the blank before each correct answer.

______a. Redwood

______b. Cherry

______c. Pecan

______d. Chestnut

______e. Sycamore

______f. Walnut

______g. Cypress

______h. Ash

______i. Mahogany

______j. Oak

______k. Ironwood

______l. Poplar

16. Select from the following list types of woods used for trim and moldings. Write an "X" in the blank before each correct answer.

______a. Hemlock

______b. Basswood

______c. Mahogany

______d. Ash

______e. Walnut

______f. Buckeye

______g. Cypress

______h. Redwood

______i. Maple

______j. Pecan

______k. Oak

______l. Birch

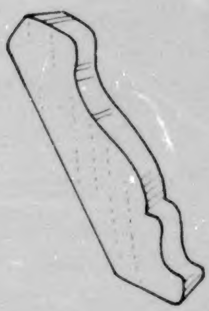
______m. White pine

______n. Persimmon

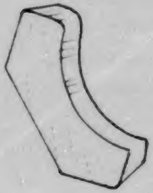
TEST

17. Identify the types of trim and moldings shown in the following illustrations. Write the correct names in the blanks. Illustrations continue on the next page. Some answers may be used more than once.

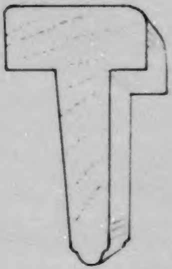
Base
Base shoe
Cap molding (cap strip)
Casing
Chair rail
Inside corner
Outside corner
Cove
Crown
Quarter round
Stop
T-astragal
Wainscot cap or batten



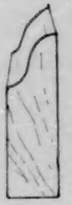
a. ____________________



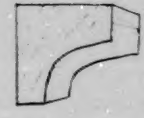
b. ____________________



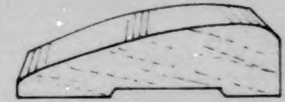
c. ____________________



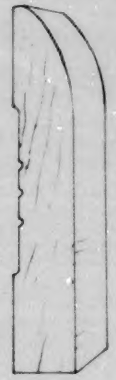
d. ____________________



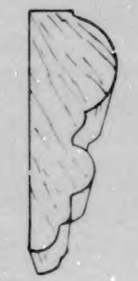
e. ____________________



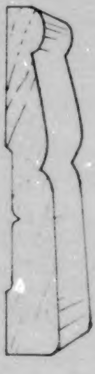
f. ____________________



g. ____________________

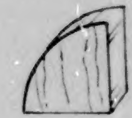


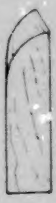
h. ____________________

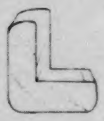


i. ____________________

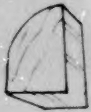
TEST

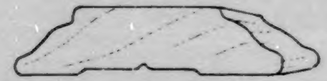


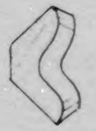




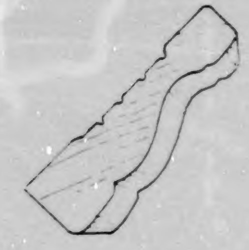
j. ____________________ k. ____________________ l. ____________________

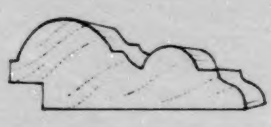


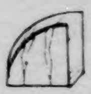




m. ____________________ n. ____________________ o. ____________________







p. ____________________ q. ____________________ r. ____________________

18. Match types of lumber to their correct units of measure. Write the correct numbers in the blanks.

_____a. Plywood, particle board, drywall, sheathing, paneling, and certain hardwoods, milled boards, and speciality products such as flooring and ceiling tile	1. Board foot 2. Square foot 3. Lineal foot
_____b. Molding and trim	
_____c. Boards, dimension lumber, structural lumber, shop and factory lumber	

(NOTE: Test questions 19 and 20 list the assignment sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

19. Compute lumber quantities.

20. Write a lumber requisition.

LUMBER
UNIT IV

ANSWERS TO TEST

1. a. 5
   b. 1
   c. 13
   d. 9
   e. 3
   f. 12
   g. 14
   h. 11
   i. 6
   j. 2
   k. 7
   l. 10
   m. 8
   n. 4

2. b, c, d, e, g, i

3. a. 6
   b. 4
   c. 1
   d. 8
   e. 2
   f. 5
   g. 7
   h. 3
   i. 9

4. **Part one**

   a. 10
   b. 7
   c. 4
   d. 5
   e. 1
   f. 9
   g. 2
   h. 3
   i. 6
   j. 8

   Part two

   a. 4
   b. 9
   c. 1
   d. 6
   e. 10
   f. 2
   g. 8
   h. 3
   i. 7
   j. 11
   k. 5

5. a. Checks
   b. Decayed knot
   c. Encased knot
   d. Bow warp
   e. Twist or wind warp
   f. Knothole
   g. Spike knot
   h. Cup warp
   i. Crook warp
   j. Intergrown knot

6. a. 2
   b. 5
   c. 3
   d. 4
   e. 1

7. a, c, d, f, g

ANSWERS TO TEST

8.
   a. 3
   b. 1
   c. 6
   d. 5
   e. 2
   f. 4

9.
   a. I, E
   b. I, E
   c. E
   d. I, E
   e. E
   f. I
   g. I
   h. E
   i. I
   j. E
   k. I, E

10.
   a. 5
   b. 7
   c. 1
   d. 3
   e. 4
   f. 2
   g. 6

11.
   a. Lumber core
   b. Particle-board core
   c. Veneer core
   d. Fiberboard core

12.
   a. 3/4" x 3 1/2"
   b. 3/4" x 5 1/2"
   c. 3/4" x 11 1/4"
   d. 1 1/2" x 3 1/2"
   e. 1 1/2" x 5 1/2"
   f. 1 1/2" x 7 1/4"
   g. 1 1/2" x 9 1/4"
   h. 3 1/2" x 5 1/2"

13.
   a. 5/16"
   b. 9/16"
   c. 1 1/16"
   d. 1 5/16"
   e. 1 9/32"
   f. 2 3/4"
   g. 3 3/4"

14. a, b, c, d, f, g

15. b, c, d, e, f, h, i, j, l

16. b, c, d, e, g, h, j, k, l, m

17.
   a. Crown
   b. Cove
   c. T-astragal
   d. Stop
   e. Cove
   f. Casing
   g. Base
   h. Chair rail
   i. Base
   j. Quarter round
   k. Stop
   l. Outside corner
   m. Base shoe
   n. Wainscot cap or batten
   o. Inside corner
   p. Casing
   q. Cap molding (cap strip)
   r. Quarter round

ANSWERS TO TEST

18. a. 2
    b. 3
    c. 1

19. Evaluated to the satisfaction of the instructor

20. Evaluated to the satisfaction of the instructor

HAND TOOLS
UNIT I

UNIT OBJECTIVE

After completing this unit, the student should be able to identify hand tools and list rules for care and safe use of hand tools. The student will show this knowledge by completing job sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with hand tools to their correct definitions.
2. State guidelines for care and safe use of hand tools.
3. Select from a list hand tools a beginning carpenter needs.
4. Match types of hammers to their correct uses.
5. Match types of handsaws to their correct uses.
6. Match types of squares to their correct uses.
7. Match types of planes to their correct uses.
8. Match types of measuring instruments to their correct uses.
9. Identify types of layout instruments.
10. Identify types of boring and drilling hand tools.
11. Identify types of screwdrivers.
12. Match types of pliers to their correct uses.
13. Identify types of wrenches.
14. Identify types of files.
15. Identify types of chisels.
16. Identify types of clamps.
17. Identify hand tools used to install drywall.
18. Match types of miscellaneous hand tools to their correct uses.

OBJECTIVE SHEET

19. Demonstrate the ability to

    a. Hone a wood chisel.

    b. Use a hacksaw.

    c. Use a framing square and rule to lay out an 8-inch wall corner.

    d. Use a level.

    e. Hand tap a hole in a piece of steel.

HAND TOOLS
UNIT I

SUGGESTED ACTIVITIES

I. Unit contents

   A. Objective sheet

   B. Suggested activities

   C. Supplement #1 — Hand Tools Crossword Puzzle

   D. Information sheet

   E. Job sheets

      1. Job Sheet #1 — Hone a Wood Chisel

      2. Job Sheet #2 — Use a Hacksaw

      3. Job Sheet #3 — Use a Framing Square and Rule to Lay Out an 8-Inch Wall Corner

      4. Job Sheet #4 — Use a Level

      5. Job Sheet #5 — Hand Tap a Hole in a Piece of Steel

   F. Test

   G. Answers to test

II. Instructor's guide

   A. Review unit and plan presentation.

   B. Obtain materials to supplement unit.

      1. Film — *Safety in the Shop: Hand Tools.* Black and white, 13.5 minutes, Coronet Films, 1970. Available from Coronet Films, 65 East Southwater Street, Chicago, Illinois 70701.

      2. Slide set — *Tool Identification Slides.* Available from the Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074.

      3. Tool catalogs

         (NOTE: Obtain several tool catalogs and display for students to review.)

SUGGESTED ACTIVITIES

4. Newspaper clippings or case studies that relate to safe hand tool use

5. Competency profiles

   (NOTE: Competency profiles for this book are available from the Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074, or from The Associated General Contractors of America, 1957 E Street, N.W., Washington, D.C. 20006, phone 202-393-2040.)

C. Introduce unit to students.

SUGGESTIONS:

- Show *Tool Identification Slides.*
- Ask students to review tool catalogs; discuss hand tools, pointing out the importance of buying good grades of tools. Tell students that quality not price should be their main concern when purchasing tools.

D. Provide students with objective sheet.

E. Discuss unit and specific objectives, emphasizing the care and safe use of hand tools.

F. Provide students with information and job sheets.

G. Discuss information and job sheets.

1. Use Information Sheet, Section I to discuss terms and definitions.

   SUGGESTIONS:

   - Discuss or demonstrate terms that may be unfamiliar to students.
   - Have students review terms by completing Supplement #1, "Hand Tools Crossword Puzzle."

2. Use Information Sheet, Section II to discuss guidelines for care and safe use of hand tools.

   SUGGESTIONS:

   - Show film *Safety in the Shop: Hand Tools.*
   - Have students explain details of accidents they know of when someone used hand tools improperly.
   - Discuss newspaper clippings or case studies that relate to safe hand tool use.
   - Demonstrate to students how to clean and store hand tools properly.

SUGGESTED ACTIVITIES

- Demonstrate how the quantity and quality of work increases when using sharp tools as compared to using dull tools.
- Explain your policy for replacement and repair of damaged tools.
- Outline your tool-management policy for shop and job site.
- Demonstrate and discuss procedures in Job Sheet #1.
- Have students complete Job Sheet #1.

3. Use Information Sheet, Section III to discuss hand tools a beginning carpenter needs.

   SUGGESTIONS:

   - Explain that although this is a complete list of the *hand* tools that a beginning carpenter needs, students will be expected to own other types of tools before starting to work.
   - Display each of the hand tools listed in this section of the information sheet.

4. Use Information Sheet, Section IV to discuss types of hammers and their correct uses.

   SUGGESTIONS:

   - Display a sample of each type of hammer discussed in this section of the information sheet. Discuss the proper use of each hammer, and allow students to handle hammers.
   - Tell students to use the correct hammer for the job it was designed for. Caution students against hitting two hammer faces together.
   - Caution students against using a hammer for a nail bar and applying excess pressure on the handle. Demonstrate correct use by using a wood block for added leverage to lessen handle pressure.

5. Use Information Sheet, Section V to discuss types of handsaws and their correct uses.

   SUGGESTIONS:

   - Display a sample of each type of handsaw discussed in this section of the information sheet. Discuss proper use of each handsaw, and allow students to handle saws.
   - Demonstrate cutting to a straight line.

SUGGESTED ACTIVITIES

- Obtain damaged saws, and caution students against mishandling that causes dull or damaged saw teeth.
- Demonstrate correct procedure for replacing the blade in a hacksaw frame so that the teeth point away from the handle.
- Demonstrate and discuss procedures in Job Sheet #2.
- Have students complete Job Sheet #2.

6. Use Information Sheet, Section VI to discuss types of squares and their correct uses.

SUGGESTIONS:

- Display a sample of each type of square discussed in this section of the information sheet. Discuss proper use of each square, and allow students to examine squares.
- Caution students about careful handling of squares: Carefully handled squares are accurate instruments; damaged squares have no place in the skilled carpenter's tool box.
- Demonstrate and discuss procedures in Job Sheet #3.
- Have students complete Job Sheet #3.

7. Use Information Sheet, Section VII to discuss types of planes and their correct uses.

SUGGESTIONS:

- Display a sample of each type of plane discussed in this section of the information sheet. Discuss proper use of each plane, and allow students to examine planes.
- Demonstrate the correct procedure for disassembling a plane, setting a plane iron and cap, and reassembling and adjusting a plane.
- Demonstrate how an improperly adjusted plane causes gouges and rough surfaces.
- Demonstrate the difference in a surface planed with a sharp plane iron and a surface planed with a dull plane iron; also point out the difference in chips.

SUGGESTED ACTIVITIES

8. Use Information Sheet, Section VIII to discuss types of measuring instruments and their correct uses.

   SUGGESTIONS:

   - Display a sample of each measuring instrument discussed in this section of the information sheet. Discuss proper use of each instrument, and allow students to examine these instruments.
   - Stress the importance of proper care of measuring instruments—improper care causes inaccurate measurements.
   - Caution students against kinking steel tapes when measuring.

9. Use Information Sheet, Section IX to discuss types of layout instruments.

   SUGGESTIONS:

   - Stress that leveling instruments are precision instruments that must be handled very carefully—an instrument that has been dropped or bumped may be inaccurate.
   - Demonstrate the procedure for setting up a builder's level, pointing out correct handling of the level and the storage case.
   - Demonstrate and discuss the procedures in Job Sheet #4.
   - Have students complete Job Sheet #4.

10. Use Information Sheet, Section X to discuss types of boring and drilling hand tools.

    SUGGESTIONS:

    - Display a sample of each type of boring and drilling tool discussed in this section of the information sheet. Discuss proper use of each boring and drilling tool, and allow students to examine these tools.
    - Demonstrate that a dull or incorrectly sharpened bit will not drill a round hole; point out that cutting edges must be protected.

11. Use Information Sheet, Section XI to discuss types of screwdrivers.

    SUGGESTIONS:

    - Display a sample of each type of screwdriver discussed in this section of the information sheet; also have various types of screws available. Allow students to examine screwdrivers and screws.

SUGGESTED ACTIVITIES

- Point out that screwdrivers must fit the screw slots properly. If the screwdriver is too large, it will damage the screw head; if the screwdriver is too small, it will be damaged.

- Provide a few pieces of hardwood and some screws. Have students practice selecting the correct screwdriver to drive each screw, and have them practice driving screws into the wood.

- Demonstrate the technique of using pilot holes to aid in driving screws. Have students practice this technique.

12. Use Information Sheet, Section XII to discuss types of pliers and their correct uses.

SUGGESTIONS:

- Display a sample of each type of plier discussed in this section of the information sheet. Discuss proper use of pliers, and allow students to examine pliers.

- Remind students to use the correct tool for the job—pliers should not be used as wrenches to adjust nuts and bolts. Point out that nuts and bolts are frequently ruined when someone uses pliers instead of a wrench.

- Have students list correct uses for pliers.

EXAMPLES: Removing jammed staple in staple gun; removing cap on used glue bottle; fishing a wire out of a hole; tying reinforcing rods and wire mesh; loosening wing nuts on scaffolding; cutting reinforcing wire mesh; cutting head off finish nail; removing bent nails; removing damaged screws

13. Use Information Sheet, Section XIII to discuss types of wrenches.

SUGGESTION:

- Display a sample of each type of wrench discussed in this section of the information sheet. Discuss proper use of wrenches, and allow students to examine wrenches.

14. Use Information Sheet, Section XIV to discuss types of files.

SUGGESTIONS:

- Display a sample of each type of file discussed in this section of the information sheet. Discuss proper use of files, and allow students to examine files.

SUGGESTED ACTIVITIES

- Caution students against using a file without a handle.

- Point out to students that files have a series of cutters set at an angle so that they cut in one direction only and that trying to file in the wrong direction ruins the file.

- Demonstrate the method of cleaning a file with a file card.

15. Use Information Sheet, Section XV to discuss types of chisels.

    SUGGESTIONS:

    - Display a sample of each type of chisel discussed in this section of the information sheet. Discuss proper use of each chisel, and allow students to examine chisels.

    - Caution students to wear eye protection when working with chisels.

    - Caution students against using chisels that have mushroomed heads.

    - Caution students against using claw hammers for striking any chisel other than a wood chisel.

16. Use Information Sheet, Section XVI to discuss types of clamps.

    SUGGESTIONS:

    - Display a sample of each type of clamp discussed in this section of the information sheet. Discuss proper use of each clamp, and allow students to examine clamps.

    - Demonstrate the use of each clamp.

17. Use Information Sheet, Section XVII to discuss hand tools used to install drywall.

    SUGGESTIONS:

    - Display a sample of each drywall tool discussed in this section of the information sheet. Discuss proper use of each drywall tool, and allow students to examine drywall tools.

    - Arrange for a field trip to a job site where drywall tools are being used.

SUGGESTED ACTIVITIES

18. Use Information Sheet, Section XVIII to discuss types of miscellaneous hand tools and their correct uses.

    SUGGESTIONS:

    - Display a sample of each type of tool discussed in this section of the information sheet. Discuss the correct use of each tool, and allow students to examine tools.
    - Discuss and demonstrate the procedures in Job Sheet #5.
    - Have students complete Job Sheet #5.

H. Set up a contest to determine which students can use each tool safely, quickly, and accurately.

I. Give test.

J. Critique test and discuss in class.

K. Reteach and retest as necessary.

L. Complete appropriate section of competency profiles.

III. Unit references

A. Feirer, John L., and Gilbert R. Hutchings. *Carpentry and Building Construction.* Peoria, Illinois: Chas. A. Bennett Co., Inc., 1976.

B. Repp, Victor E., and Willard J. McCarthy. *Machine Tool Technology,* 4th ed. Bloomington, Illinois: McKnight Publishing Company, 1979.

C. *Stanley Tools Consumer Broad Line Catalog.* Dallas, Texas: South Central Corporate Distribution Center, 1982.

D. *Starrett Precision Tools, Gages, and Saws,* 1st ed., Catalog No. 28. Athol, Massachusetts: The L. S. Starrett Company, 1979.

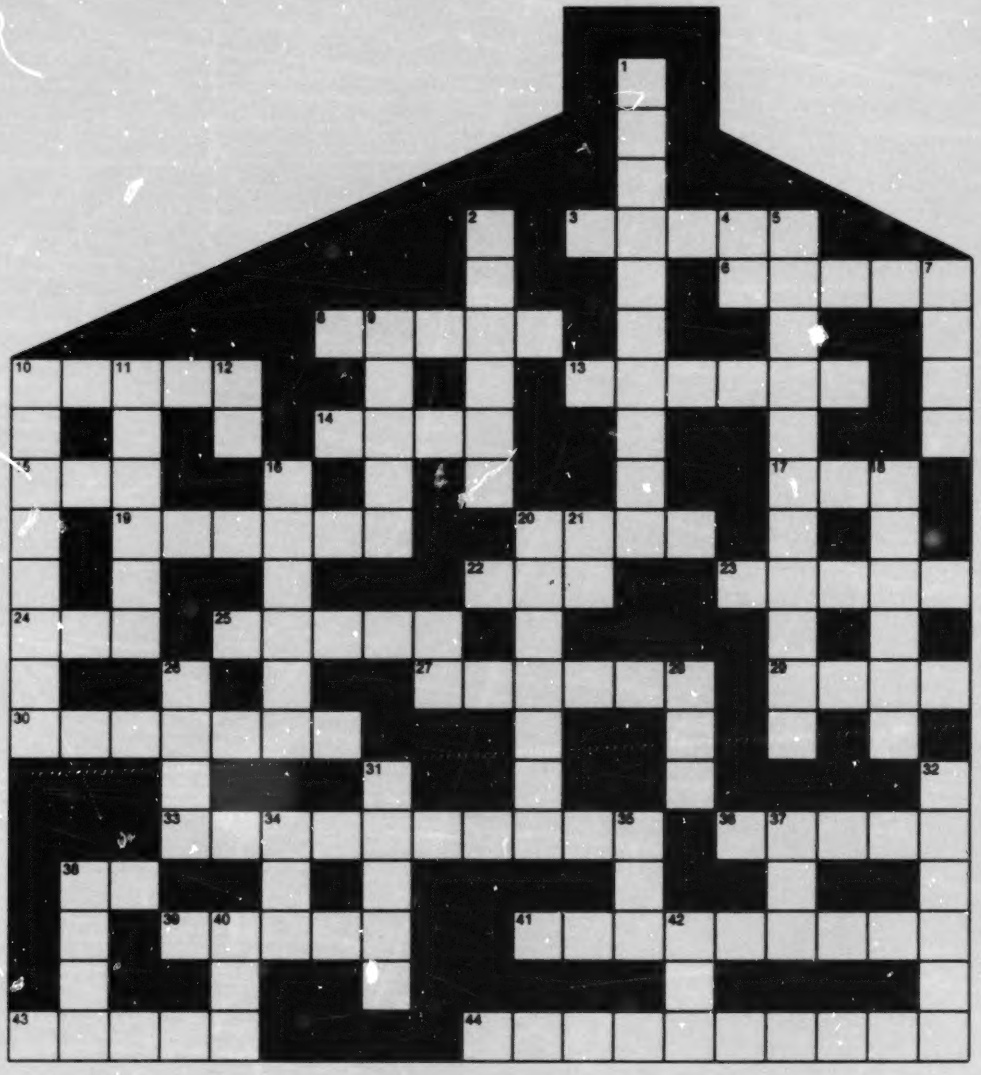
E. Wagner, Willis H. *Modern Carpentry.* South Holland, Illinois: The Goodheart-Willcox Co., Inc., 1976.

F. Zook, Wayne H. *Constructing and Manufacturing Wood Products.* Bloomington, Illinois: McKnight Publishing Company, 1973.

SUGGESTED ACTIVITIES

SUPPLEMENT #1 — HAND TOOLS CROSSWORD PUZZLE

Use Information Sheet, Section I and the clues on the following page to complete the hand tools crossword puzzle below.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SUPPLEMENT #1

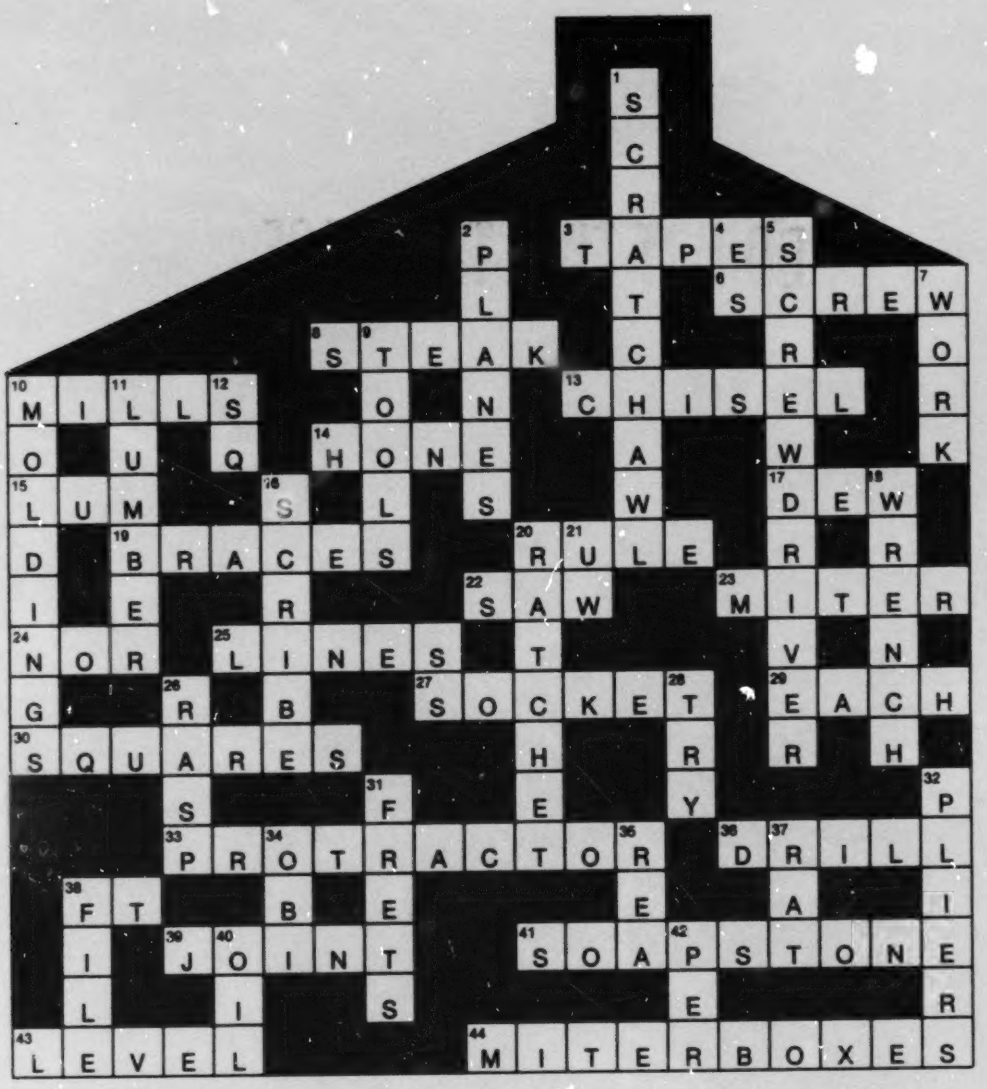
ACROSS

3. Felxible measuring tools
6. Metal rod with head and threaded shank
8. Red meat
10. Places that surface lumber
13. For example, wood, cold, brick, or stripping
14. To sharpen with a whetstone or oilstone
15. Lumber (abbr.)
17. Moisture that condenses after a warm day
19. Tools used to hold and operate bits
20. Folding measuring instrument
22. For example, crosscut, dovetail, or coping
23. Cut made at an angle for joining two pieces of wood
24. Neither, - - -
25. Cords used for laying out building work
27. Accessory for ratchet wrench
29. Both of two
30. See 28 Down
33. Instrument for laying out angles
36. Tool used to make holes in wood or metal
38. Foot (abbr.)
39. Place where two or more surfaces meet
41. Soft stone used for marking metal
43. Tool used to check level or plumb
44. Devices for guiding a backsaw at proper angle for cutting a miter in wood

DOWN

1. Sharp, pointed piece of steel used for marking wood or steel
2. Tools used to remove excess wood from surfaces
4. Plural ending for box
5. Tool used to drive screws
7. Entire scope of activity performed at construction site
9. Saws, hammers, chisels, drills, etc.
10. Strips of wood or plastic used for decorative purposes
11. Any material cut from timber
12. Square (abbr.)
16. Type of divider
18. Tool used to set up and adjust machinery and to work with metal and hardware fasteners
20. Type of wrench that allows torque to be applied
21. Underwriters (abbr.)
26. Coarse, file-like tool used to shape and finish wood
28. With 30 Across, tools used to measure and check 45-degree and 90-degree angles
31. Ornamental patterns
32. Tools used to hold, bend, shape, and cut wire
34. Japanese sash
35. Rural Electric Association (abbr.)
37. Rodent
38. Tool with single-cut or double-cut teeth used for finishing wood or metal surfaces
40. Lubricant
42. $1.00 - - - dozen

SOLUTION TO SUPPLEMENT #1


1 S
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L T 6 S C R E W 7
8 S 9 T E A K C R O
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O U Q 14 H O N E A W K
15 L U M 16 S L S W 17 D E W 18
D 19 B R A C E S 20 R 21 U L E R R
I E R 22 S A W 23 M I T E R
24 N O R 25 L I N E S T V N
G 26 R B 27 S O C K E T 28 29 E A C H
30 S Q U A R E S H R R H
S 31 F E Y 32 P
33 P R 34 O T R A C T O R 35 36 D 37 R I L L
38 F T B E E A I
I 39 J 40 O I N T 41 S O A 42 P S T O N E
L I S E R
43 L E V E L 44 M I T E R B O X E S

HAND TOOLS
UNIT I

INFORMATION SHEET

I. Terms and definitions

   A. Joint — Place where two or more surfaces meet

   B. Miter — Cut made at an angle for joining two pieces of wood so that they will form an angle

   C. Miter box — Device for guiding a backsaw at the proper angle for cutting a miter joint in wood

   D. Fret — Ornamental pattern

   E. Molding — Strip of wood, plastic, or metal used for decorative purposes

   F. Protractor — Instrument for laying out angles

   G. Try miter — Instrument for marking and checking angles

   H. Soapstone — Soft stone having a soapy feel; used for marking metal

   I. Hone — To sharpen with a whetstone or oilstone

II. Guidelines for care and safe use of hand tools

   A. Use the correct tool for the job

   B. Keep tools sharp

   C. Keep tools clean

   D. Inspect tools frequently to make sure they are in good condition

   E. Repair broken or damaged tools promptly

   F. Dispose of broken or damaged tools that cannot be repaired

   G. Store tools properly when not in use

   EXAMPLES: Do not carry tools in your pockets; do not place tools on workbench where they can roll off; protect cutting edges; lightly oil tools before storing; store tools in dry place.

   H. Stay alert when using tools

   EXAMPLES: Keep fingers away from cutting edges; work away from your body when using cutting tools.

   I. Wear eye protection when necessary

INFORMATION SHEET

III. Hand tools a beginning carpenter needs

(NOTE: Carpenters are expected to own this set of hand tools before starting to work.)

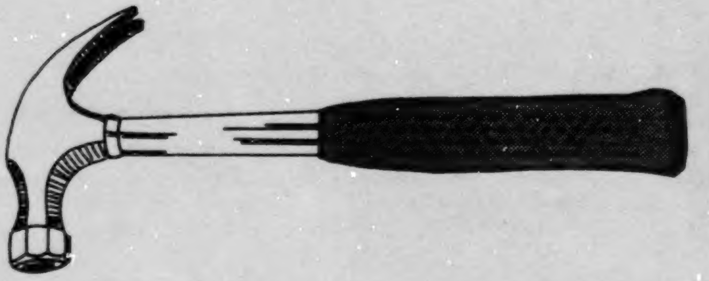
A. Hammer
B. Handsaw
C. Hacksaw
D. Chalk line
E. One-hundred-foot tape
F. Rule or tape
G. Square
H. Level
I. Utility knife
J. Hand brace and bit
K. Plane
L. Standard screwdrivers
M. Phillips screwdrivers
N. Pliers
O. Adjustable wrench
P. File
Q. Chisel
R. Ripping or pry bar
S. Scratch awl

IV. Uses of types of hammers (Figures 1-3)

A. Curved-claw hammer — Used to drive and pull nails

EXAMPLE:

FIGURE 1



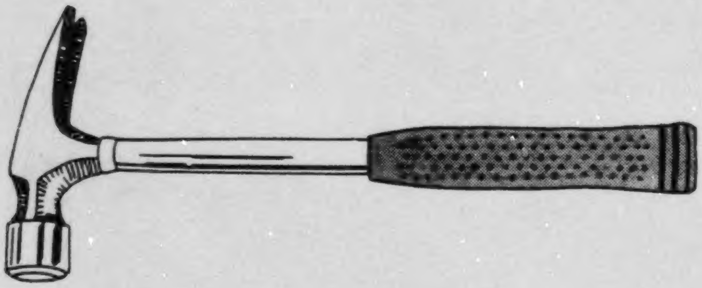
Curved-claw hammers weigh from 13 ounces to 20 ounces; handles are made of wood, fiberglass, or steel.

INFORMATION SHEET

B. Straight-claw hammer — Used to drive nails, pull nails, dismantle, and wreck

EXAMPLE:

FIGURE 2

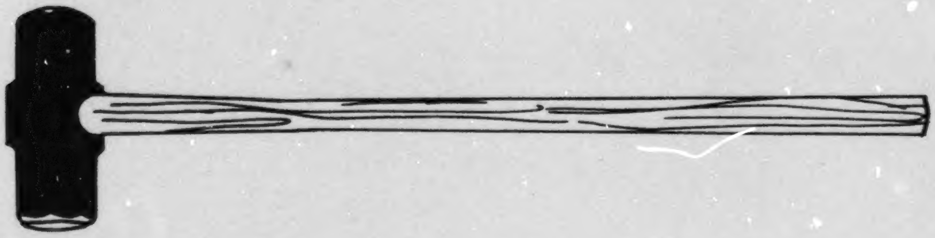


Standard straight-claw hammers weigh from 16 ounces to 21 ounces; straight-claw hammers weighing from 22 ounces to 28 ounces are called *framing hammers.*

C. Sledgehammer — Used to drive stakes and break concrete

EXAMPLE:

FIGURE 3



Sledgehammers weigh from 2 pounds to 20 pounds; they have a balanced head with two identical faces.

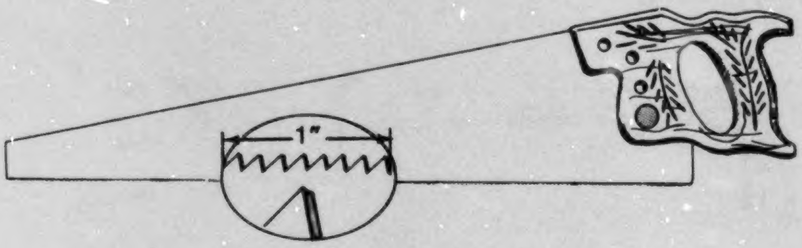
INFORMATION SHEET

V. Uses of types of handsaws (Figures 4-10)

A. Crosscut saw — Used to cut across the grain of wood

EXAMPLE:

FIGURE 4

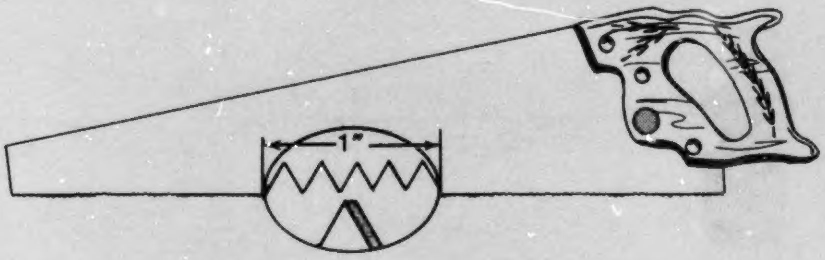


Crosscut saws come in lengths of 20 inches to 26 inches with four to twelve points per inch; teeth are filed at an angle across the face.

B. Ripsaw — Used to cut with the grain of wood

EXAMPLE:

FIGURE 5



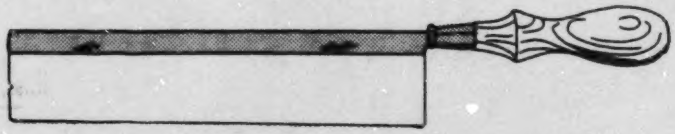
Ripsaws come in lengths of 20 inches to 28 inches with five to seven points per inch; teeth are filed square across the face.

INFORMATION SHEET

C. Dovetail saw — Used to cut smoothest possible joints (tenons, mortises, etc.)

EXAMPLE:

FIGURE 6

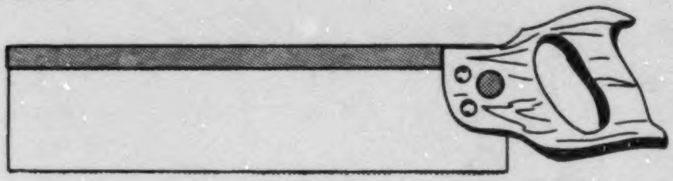


Dovetail saws are 10 inches long with seventeen points per inch; they have very fine teeth and an extremely thin steel blade with a rigid steel back to strengthen the blade.

D. Backsaw (miter-box saw) — Used to cut fine joints; also used in a miter box to cut miters or square ends

EXAMPLE:

FIGURE 7

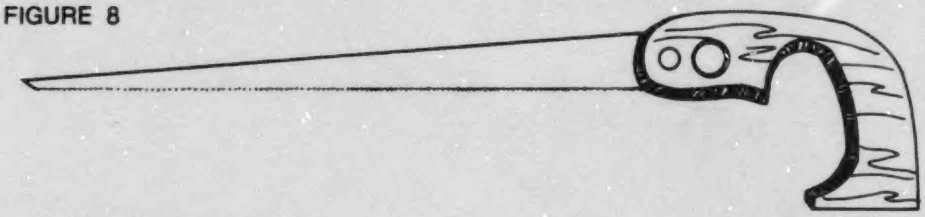


Backsaws come in lengths of 12 inches to 28 inches with eleven to thirteen points per inch; they have fine teeth, a thin blade, and a heavy steel band across the back to strengthen the blade.

E. Compass saw (keyhole saw) — Used to cut inside corners, curves, circles, and frets

EXAMPLE:

FIGURE 8



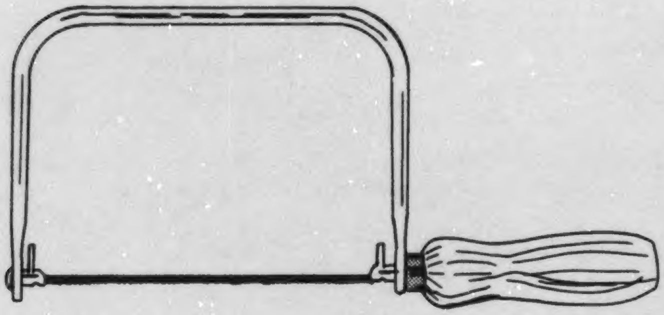
Compass saws come in lengths of 10 inches to 14 inches; their tapered blade can be reversed or set in various positions; some have a replaceable blade.

INFORMATION SHEET

F. Coping saw — Used to cut curves and to shape ends of molding and trim for joints

EXAMPLE:

FIGURE 9

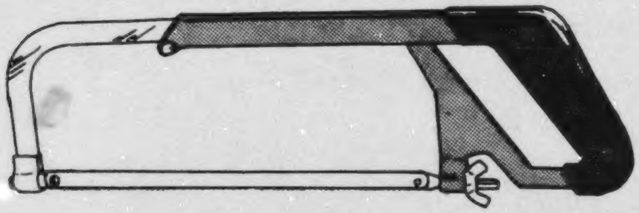


The coping saw's U-shaped frame permits cuts as deep as 6¾ inches; blade is replaceable.

G. Hacksaw — Used to cut metal

EXAMPLE:

FIGURE 10



Hacksaws have U-shaped frames and replaceable blades that come in lengths of 8 inches to 12 inches.

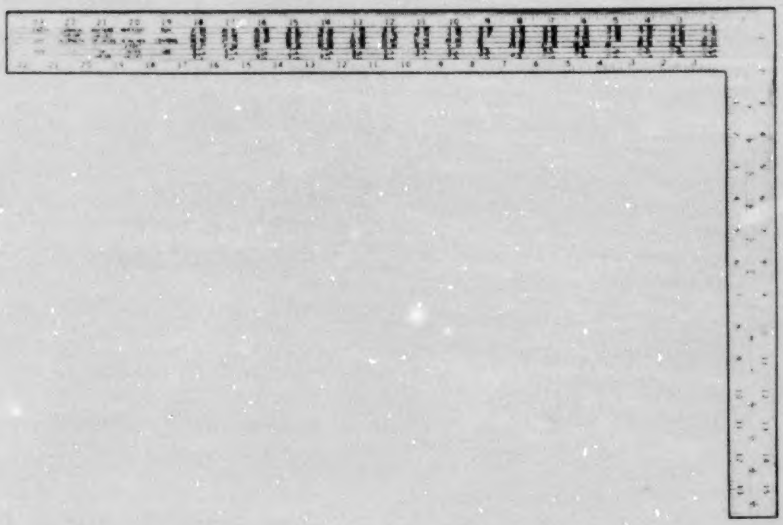
INFORMATION SHEET

VI. Uses of types of squares (Figures 11-15)

A. Framing square (rafter square) — Used in general framing to lay out walls, partitions, rafters, braces, and stairs

EXAMPLE:

FIGURE 11

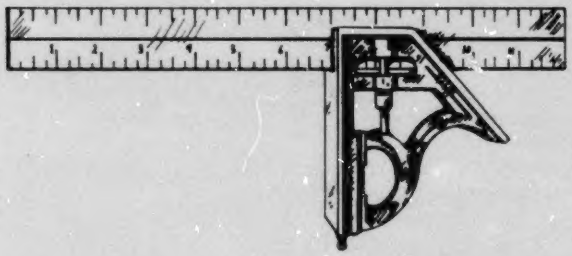


Framing squares have a 24-inch-by-2-inch calibrated blade and a 16-inch-by-1½-inch calibrated tongue. Rafter and brace tables are stamped on the blade.

B. Combination square — Used to check squareness and to mark 45-degree miters

EXAMPLE:

FIGURE 12



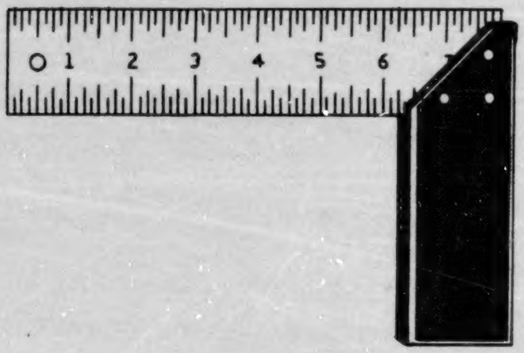
Combination squares have a 12-inch blade and an adjustable handle that contains a level vial and a scribe (scratch awl). Handles are made with a 45-degree and a 90-degree side.

INFORMATION SHEET

C. Try square — Used to measure and check 45-degree and 90-degree angles

EXAMPLE:

FIGURE 13

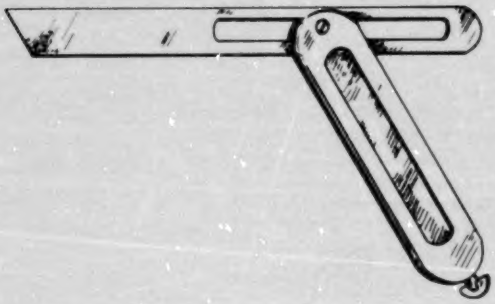


Try squares have a 6-inch to 12-inch blade that is graduated every ⅛ inch; their stationary handle comes in lengths of 4⅜ inches to 8 inches.

D. Sliding T-bevel — Used to measure or transfer angles from 0 degree to 180 degrees and to check miter cuts

EXAMPLE:

FIGURE 14



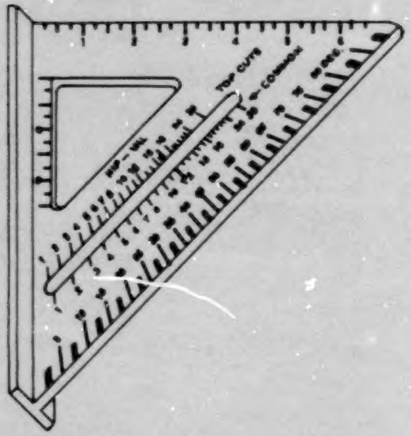
Sliding T-bevels have a solid wood or metal handle, an adjustable metal blade that comes in lengths of 4 inches to 8 inches, and a locking device.

INFORMATION SHEET

E. Speed square — Used to mark and check angles

EXAMPLE:

FIGURE 15



Speed squares are combination tools consisting of a protractor, try miter, and framing square. Standard speed squares are 6-inch triangular tools with a large triangle and a smaller inner triangle. The large triangle has a 6-inch scale on one edge, a full 90-degree scale on one edge, and a T-bar on the third edge. The inner triangle has a $2\frac{1}{2}$-inch scale on one side. Twelve-inch speed squares are used for stair layout.

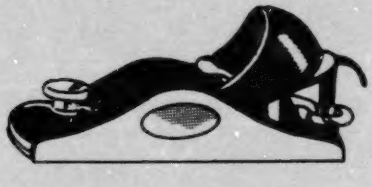
VII. Uses of types of planes (Figures 16-19)

(NOTE: Planes are used to remove excess wood from surfaces and leave them smooth and straight. Planes come in a variety of sizes. Plane frames are made of wood or metal; their blades are made of steel called *plane iron.* The two general types of planes are the hand-operated block planes and the bench planes.)

A. Block plane — Used to plane small pieces, edges, joint surfaces, and grain or cross grain when a small amount of change is required

EXAMPLE:

FIGURE 16



Block planes come in 4-inch to 7-inch lengths and $1\frac{3}{8}$-inch to $1\frac{5}{8}$-inch widths. Some block planes are fully adjustable, including the mouth; blades may be set from 12 degrees to 21 degrees.

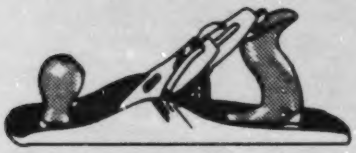
INFORMATION SHEET

B. Bench planes

1. Jack plane — Used to plane rough work to produce a fairly smooth surface

   EXAMPLE:

FIGURE 17

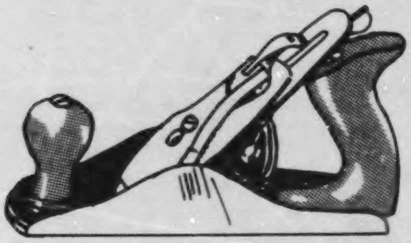


Jack planes are 14 inches long and 2 inches wide; they have a fully adjustable blade and a hardwood handle and knob.

2. Smoothing plane — Used to plane small work to a smooth and even surface without taking off too much material

   EXAMPLE:

FIGURE 18



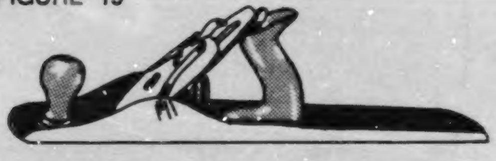
Smoothing planes come in lengths of 7 inches to 10 inches and widths of 1⅝ inches to 2 inches. They have a hardwood handle and knob and a fully adjustable blade. Some smoothing planes have an adjustable mouth opening.

INFORMATION SHEET

3. Jointer plane — Used to plane and true long boards such as edges for wood doors

EXAMPLE:

FIGURE 19



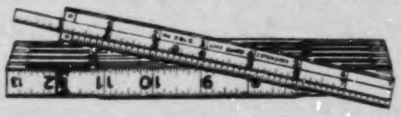
Jointer planes come in 18-inch to 30-inch lengths; their cutting edge is ground straight and is set for a fine cut.

VIII. Uses [illegible] types of measuring instruments (Figures 20-22)

A. Folding rule (zigzag rule) — Used to make accurate inside measurements

EXAMPLE:

FIGURE 20



Folding rules come in 6-foot or 8-foot lengths.

B. Flexible steel tape — Used to measure irregular as well as regular shapes and to make accurate inside measurements

EXAMPLES:

FIGURE 21

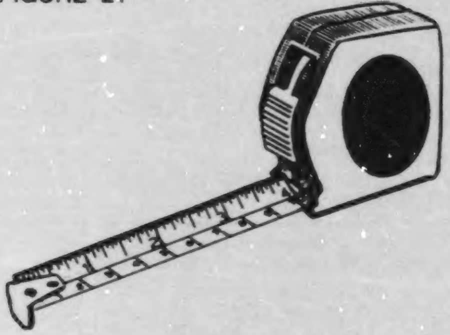
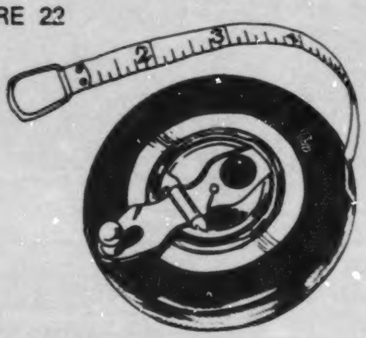


FIGURE 22



Flexible steel tapes slide into a metal case. Most short tapes come in 6-foot to 25-foot lengths; long tapes come in 50-foot to 100-foot lengths. Both types of flexible steel tapes have a hook or loop on the end adjusted to true zero.

INFORMATION SHEET

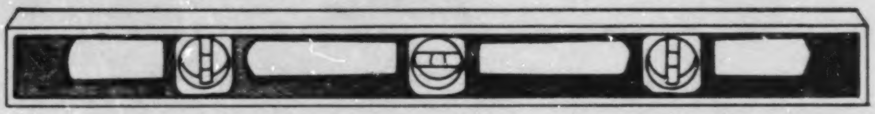
IX. Types of layout instruments

A. Levels (Figures 23-28)

(NOTE: Levels are used to check whether a surface is level or plumb.)

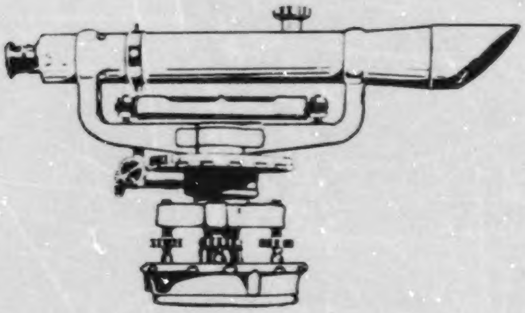
1. Spirit level

FIGURE 23



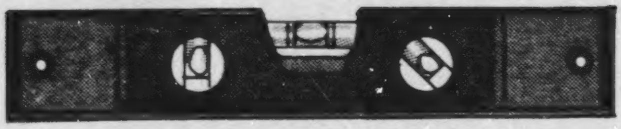
2. Builder's level

FIGURE 24



3. Torpedo level

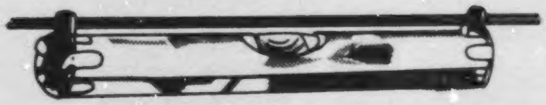
FIGURE 25



INFORMATION SHEET

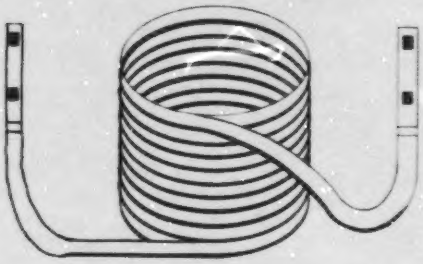
4. Line level

FIGURE 26



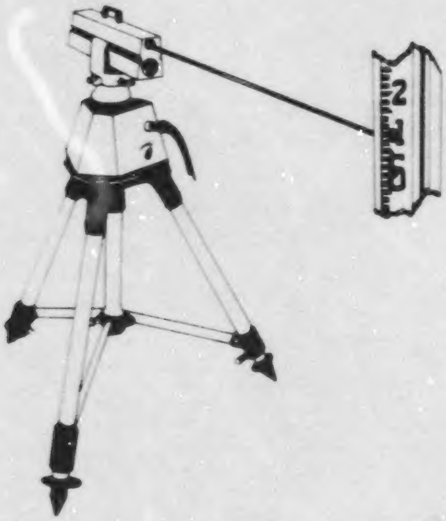
5. Water level

FIGURE 27



6. Laser-beam level

FIGURE 28

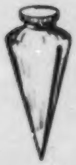


INFORMATION SHEET

B. Plumb bob (Figure 29)

(NOTE: Plumb bobs are used to establish building lines and corners and to check vertical lines.)

FIGURE 29

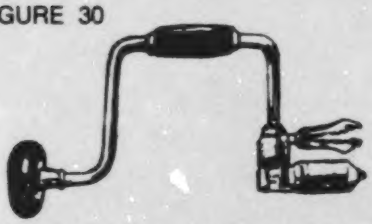


X. Types of boring and drilling hand tools

A. Boring tools (Figures 30-33)

1. Hand brace

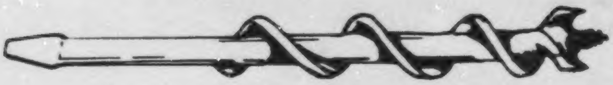
FIGURE 30



Hand braces are used to hold and operate bits.

2. Auger bit

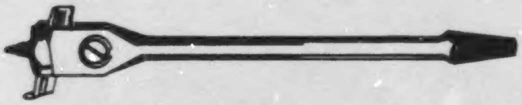
FIGURE 31



Auger bits come with a single-twist or a double-twist; sizes range from ¼ inch (No. 4) to 1 inch (No. 16).

3. Expansive bit (expansion bit)

FIGURE 32

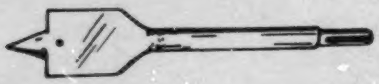


Expansive bits hold cutters of different sizes. One cutter will bore holes in the 1-inch to 2-inch range; a second cutter will bore holes in the 2-inch to 3-inch range.

INFORMATION SHEET

4. Power bit (flat bit, speed bit)

FIGURE 33

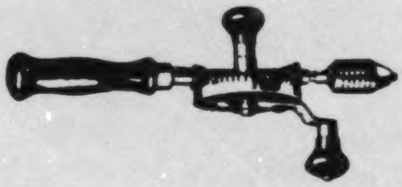


Power bits are available in sizes ranging from ¼ inch to 1½ inches by 1/16-inch increments. They have become increasingly popular because the shank is ¼ inch on all sizes.

B. Drilling tools (Figures 34-38)

1. Hand drill (eggbeater)

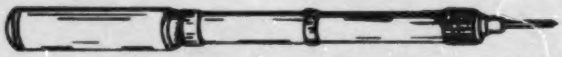
FIGURE 34



Hand drills are used to hold twist drills for drilling small holes.

2. Push drill (automatic drill)

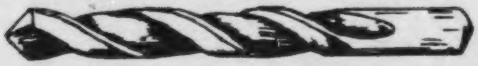
FIGURE 35



Push drills are tools with a drill point and a handle; they are used to drill many small holes.

3. Twist drill (spiral drill)

FIGURE 36

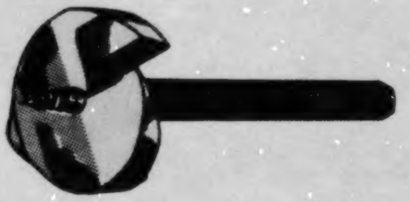


Twist drills are used to drill small holes for nails, screws, etc. Most twist-drill sets range from 1/64 inch to ½ inch.

INFORMATION SHEET

4. Lockset bit

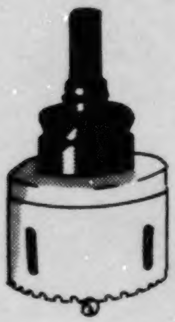
FIGURE 37



Lockset bits are used to make cuts for holding a lock in a door.

5. Hole saw

FIGURE 38



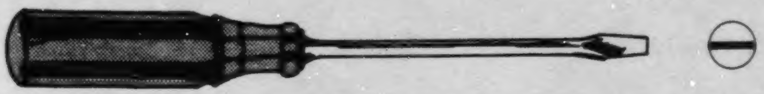
Hole saws consist of a hollow cylinder with teeth around its edge; they are used for cutting round holes.

XI. Types of screwdrivers (Figures 39-48)

(NOTE: Select a screwdriver that is shaped to fit the screw slot properly and is ground to the correct size. If the screwdriver is too large, it will damage the screw head. If the screwdriver is too small, it will be damaged.)

A. Standard screwdriver (flat-blade screwdriver)

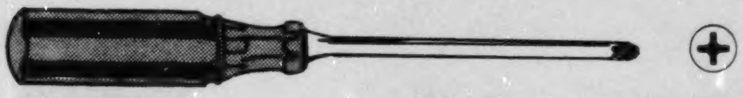
FIGURE 39



INFORMATION SHEET

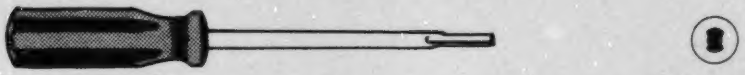
B. Phillips screwdriver

FIGURE 40



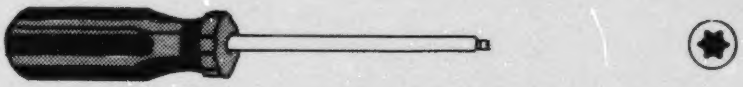
C. Clutch-head screwdriver

FIGURE 41



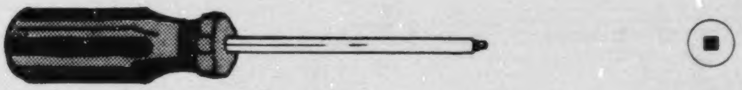
D. Torx-head screwdriver

FIGURE 42



E. Square-head screwdriver (Robertson screwdriver)

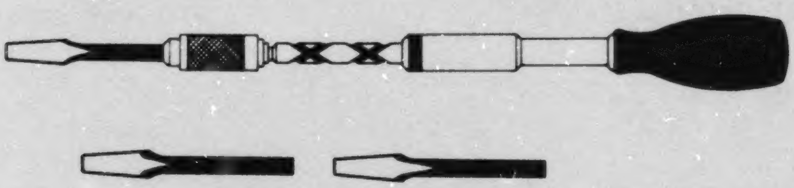
FIGURE 43



INFORMATION SHEET

F. Spiral ratchet screwdriver (automatic screwdriver)

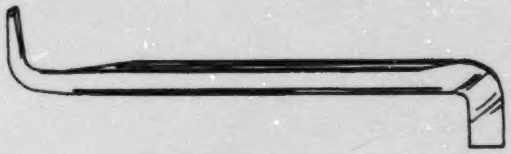
FIGURE 44



Spiral ratchet screwdrivers operate with a pushing-up-and-down action rather than with a turning action.

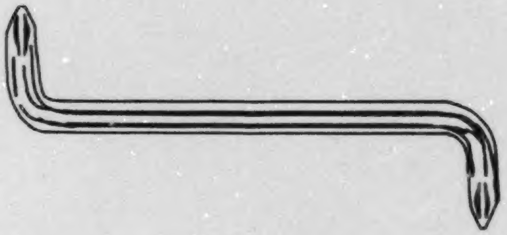
G. Standard offset screwdriver

FIGURE 45



H. Phillips offset screwdriver

FIGURE 46

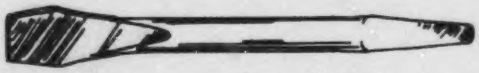


INFORMATION SHEET

I. Standard screwdriver bit

(NOTE: Standard screwdriver bits must be used with a hand brace.)

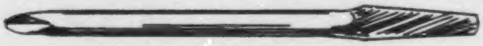
FIGURE 47



J. Phillips screwdriver bit

(NOTE: Phillips screwdriver bits must be used with a hand brace.)

FIGURE 48

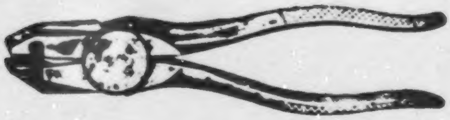


XII. Uses of types of pliers (Figures 49-52)

A. Side-cutting pliers — Used to hold, bend, shape, and cut wire

EXAMPLE:

FIGURE 49

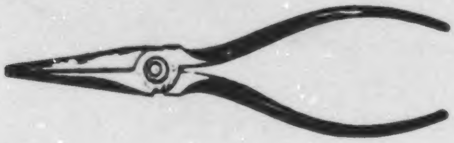


INFORMATION SHEET

B. Needle-nose pliers — Used to hold and bend thin wire and metal fittings and to hold small objects in tight places

EXAMPLE:

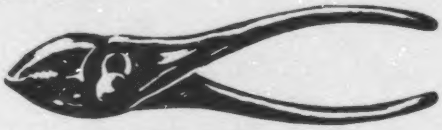
FIGURE 50



C. Combination slip-joint pliers — Used to hold and turn small round parts

EXAMPLE:

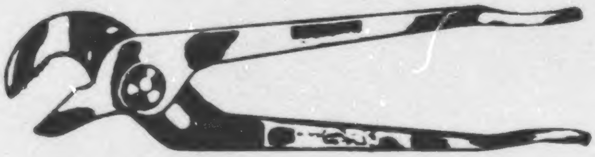
FIGURE 51



D. Channel-lock pliers — Used to hold and turn large round parts

EXAMPLE:

FIGURE 52



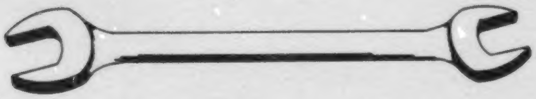
INFORMATION SHEET

XIII. Types of wrenches (Figures 53-60)

(NOTE: In building construction, wrenches are used to set up and adjust machinery and to work with metal hardware and fasteners.)

A. Open-end wrench

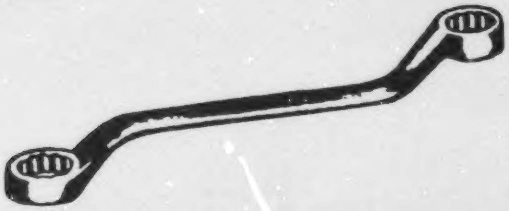
FIGURE 53



Open-end wrenches have an accurately machined, nonadjustable opening in each end; sizes of these openings are stamped on the tool. Open-end wrenches are used where there is plenty of clearance for movement.

B. Box-end wrench

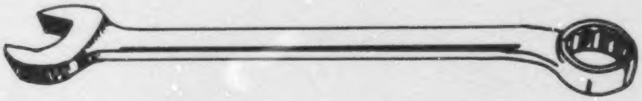
FIGURE 54



Box-end wrenches have two enclosed, nonadjustable heads that may be offset from 15 degrees to 45 degrees; they are used where there is limited space for movement.

C. Combination wrench

FIGURE 55

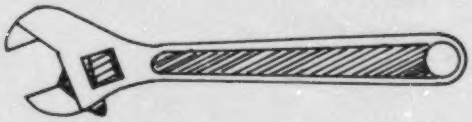


Combination wrenches have an open-end wrench at one end and a box-end wrench at the other end.

INFORMATION SHEET

D. Adjustable wrench

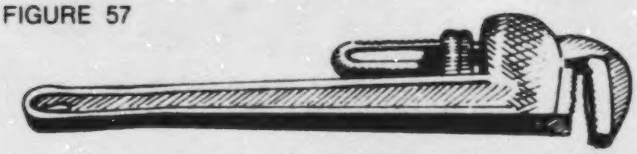
FIGURE 56



Adjustable wrenches have one adjustable jaw and one fixed jaw; they are used where there is plenty of clearance for movement.

E. Pipe wrench

FIGURE 57



Pipe wrenches have one fixed jaw and one adjustable jaw; they are used to work on pipes and rods.

F. Allen wrench (hex-key wrench)

FIGURE 58

Allen wrenches are hexagonal steel bars with bent ends; they are used to tighten and loosen setscrews.

G. Ratchet wrench and socket

FIGURE 59: Ratchet wrench

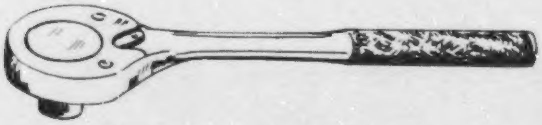
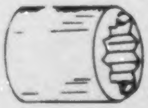


FIGURE 60: Socket



Ratchet wrenches contain a ratchet that allows torque to be applied in one direction only; sockets of various sizes may be attached to the wrench.

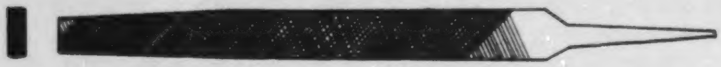
INFORMATION SHEET

XIV. Types of files (Figures 61-68)

(NOTE: Files are used to smooth and shape surfaces on which edge-cutting tools cannot be used. Files come in various shapes, sizes, and types of cuts.)

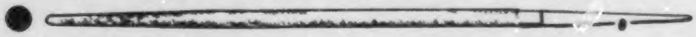
A. Flat

FIGURE 61



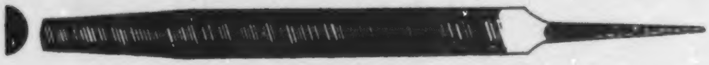
B. Round

FIGURE 62



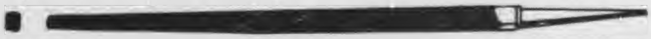
C. Half-round

FIGURE 63



D. Square

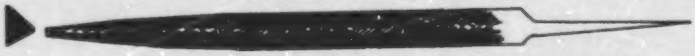
FIGURE 64



INFORMATION SHEET

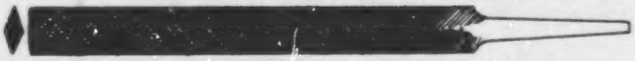
E. Triangular (three-square)

FIGURE 65



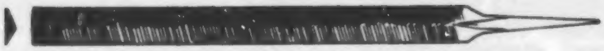
F. Slitting

FIGURE 66



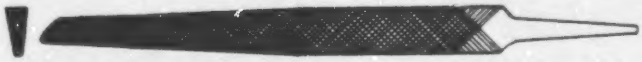
G. Cant saw

FIGURE 67



H. Knife

FIGURE 68



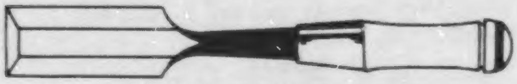
XV. Types of chisels (Figures 69-74)

(NOTE: Chisels are used for joint construction, for removal or stripping of excess material, and for cutting masonry and steel.)

INFORMATION SHEET

A. Wood chisel

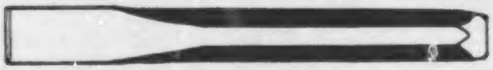
FIGURE 69



Wood chisels come in blade sizes of ¼-inch to 2 inches in ¼-inch increments.

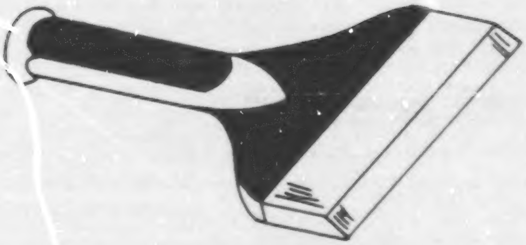
B. Cold chisel

FIGURE 70



C. Brick chisel

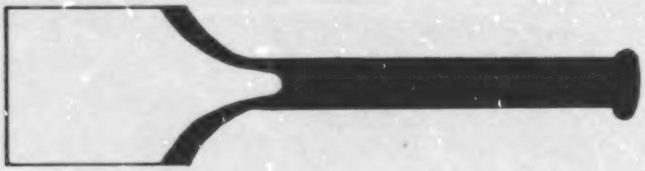
FIGURE 71



INFORMATION SHEET

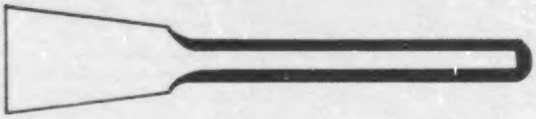
D. Stripping chisel

FIGURE 72



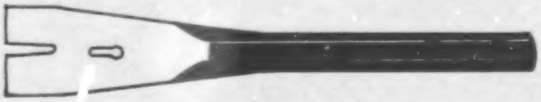
E. Floor chisel (straight-blade chisel)

FIGURE 73



F. Ripping chisel

FIGURE 74



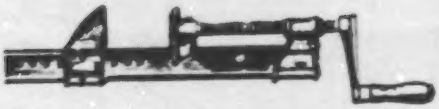
XVI. Types of clamps (Figures 75-80)

(NOTE: Clamps are tools for binding or pressing two or more parts together and holding them firmly in their relative positions; they are often used to hold pieces of wood together while the glue dries.)

INFORMATION SHEET

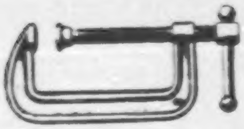
A. Bar clamp

FIGURE 75



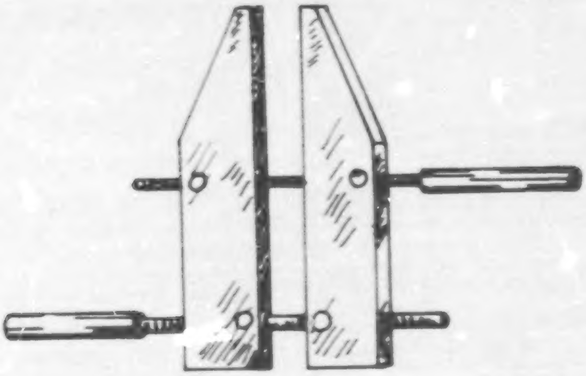
B. C-clamp

FIGURE 76



C. Hand-screw clamp

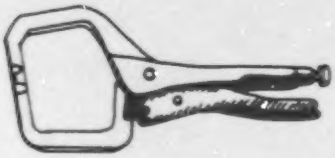
FIGURE 77



INFORMATION SHEET

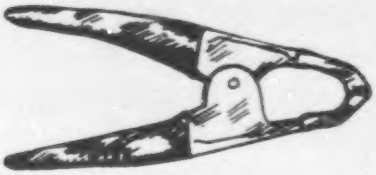
D. Locking C-clamp

FIGURE 78



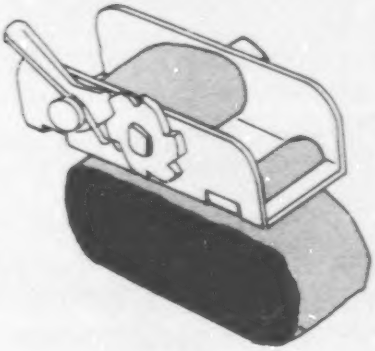
E. Spring clamp

FIGURE 79



F. Web clamp (strap clamp)

FIGURE 80

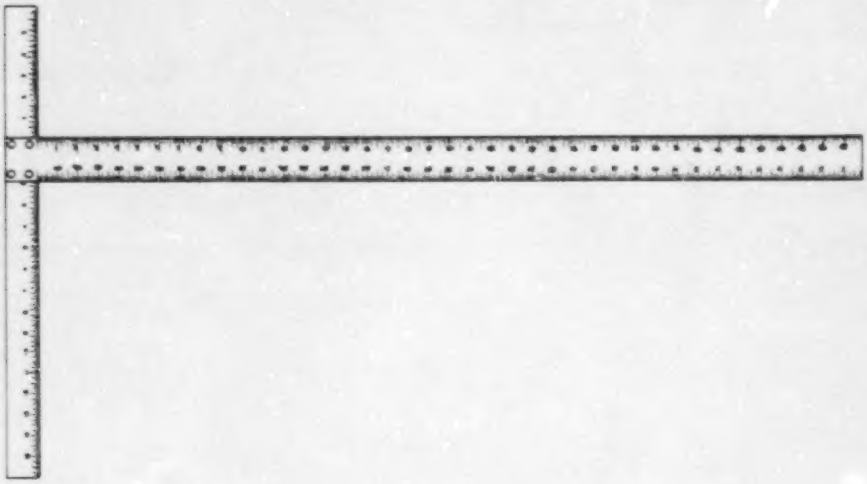


INFORMATION SHEET

XVII. Hand tools used to install drywall (Figures 81-94)

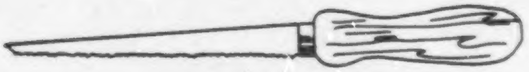
A. Drywall T-square

FIGURE 81



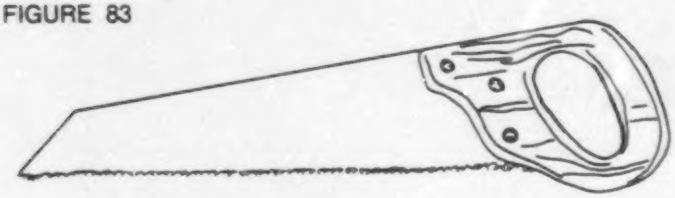
B. Utility saw

FIGURE 82



C. Wallboard saw

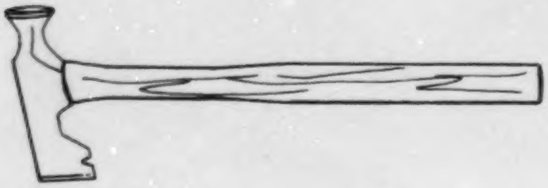
FIGURE 83



INFORMATION SHEET

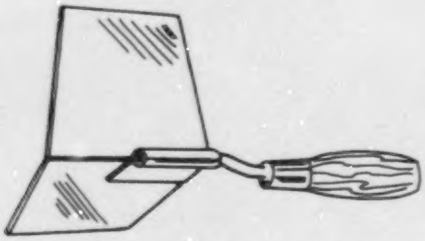
D. Drywall hammer

FIGURE 84



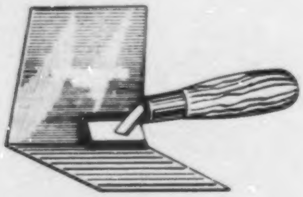
E. Outside-corner tool

FIGURE 85



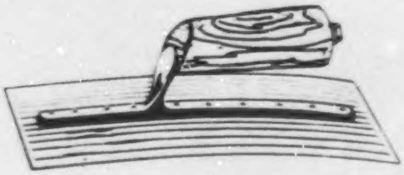
F. Inside-corner tool

FIGURE 86



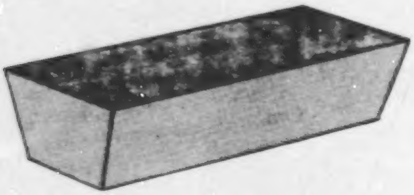
G. Trowel

FIGURE 87



H. Mud pan

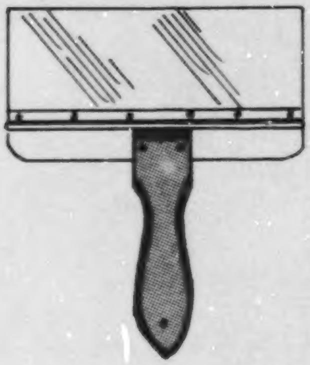
FIGURE 88



INFORMATION SHEET

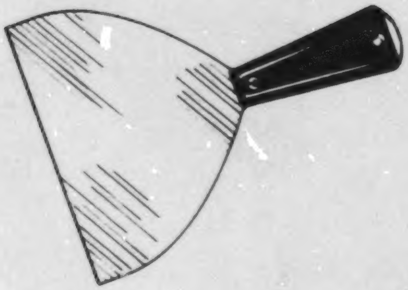
I. Taping knife

FIGURE 89



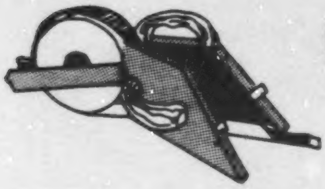
J. Elastic knife

FIGURE 90



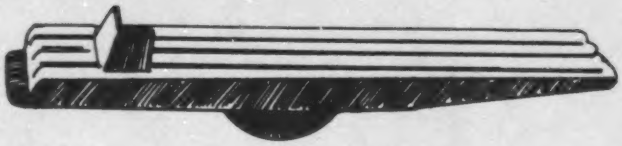
K. Taping machine (banjo)

FIGURE 91



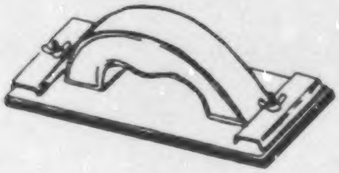
L. Drywall lifter

FIGURE 92



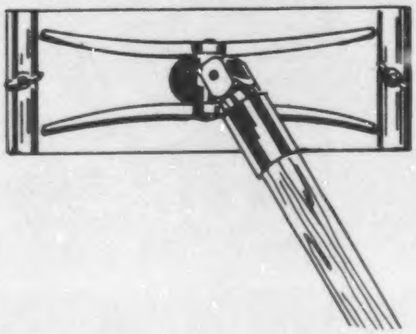
M. Hand sander

FIGURE 93



N. Long-handled sander

FIGURE 94



INFORMATION SHEET

XVIII. Uses of miscellaneous hand tools (Figures 95-103)

A. Divider and scribe — Used to lay out an arc or circle, to step off measurements, and to divide distances along a straight line

EXAMPLES:

FIGURE 95: Divider

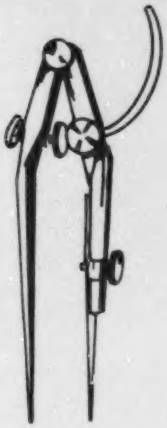


FIGURE 96: Pencil divider

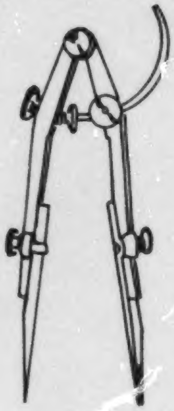
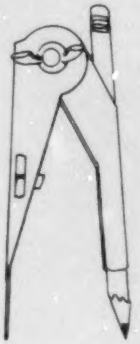


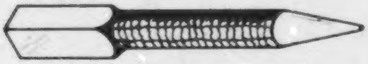
FIGURE 97: Scribe



B. Nail set — Used to sink a nail below the surface

EXAMPLE:

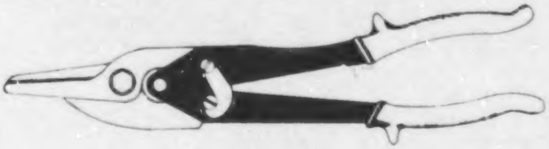
FIGURE 98



C. Tin snips — Used to cut lightweight metal

EXAMPLE:

FIGURE 99: Aviation-type tin snips

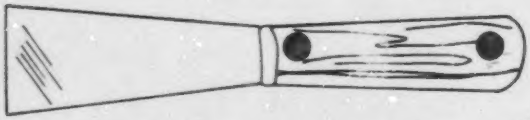


INFORMATION SHEET

D. Putty knife — Used to scrape and apply putty and wood fillers

EXAMPLE:

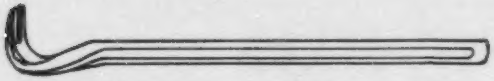
FIGURE 100



E. Nail claw — Used to pull nails

EXAMPLE:

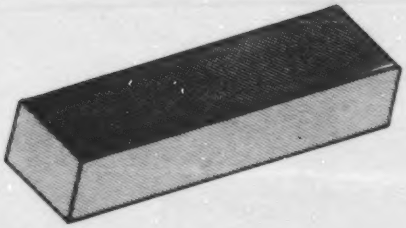
FIGURE 101



F. Oilstone — Used to hone the final keen edge on tools with cutting edges

EXAMPLE:

FIGURE 102

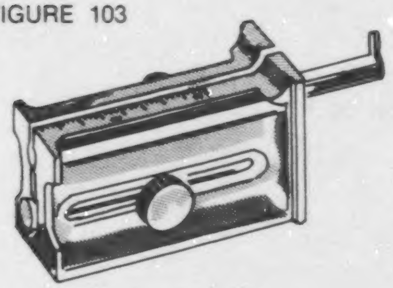


INFORMATION SHEET

G. Butt gauge — Used to mark for position and thickness of the butt hinges on doors and door casings, and to mark location of lock plates and strike plates

EXAMPLE:

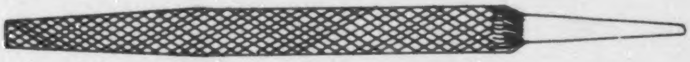
FIGURE 103



H. Wood rasp — Used to shape and finish wood

EXAMPLE:

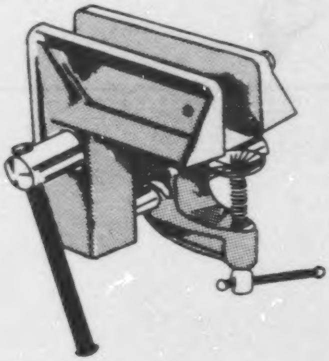
FIGURE 104



I. Woodworker's vise — Used to hold a workpiece while planing or trimming

EXAMPLE:

FIGURE 105



INFORMATION SHEET

J. Tap and tap wrench — Used to form an internal screw thread

EXAMPLES:

FIGURE 106: Tap

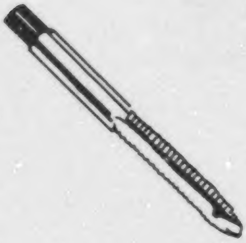
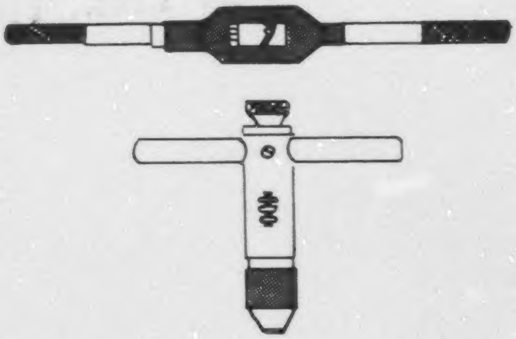


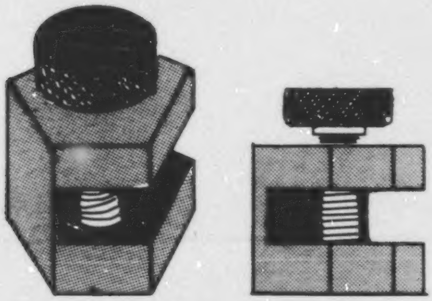
FIGURE 107: Tap wrench



K. Stair gauge — Used with a framing square to lay out correct angle of riser height and tread run for each step on stair carriage

EXAMPLE:

FIGURE 108



HAND TOOLS
UNIT I

JOB SHEET #1 — HONE A WOOD CHISEL

I. Tools and equipment

   A. Wood chisel

   B. Oilstone

II. Procedure

   (NOTE: All tools with single-bevel cutting edges [including plane irons] can be honed using this procedure, but bevel angles will differ slightly with other tools.)

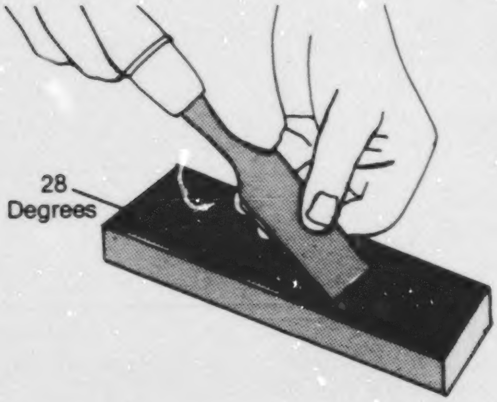
   A. Secure oilstone so that it will not slide

   B. Place chisel on oilstone with bevel side flat against surface of oilstone

   C. Raise chisel handle slightly to achieve a 25-degree to 30-degree angle (Figure 109)

      (NOTE: Just the cutting edge of the chisel should be in contact with the surface of the oilstone.)

FIGURE 109



   D. Hone chisel by moving it back and forth over the entire surface of the oilstone until a very light burr can be felt on the edge of the bevel

   E. Turn chisel over bevel side up; lay chisel flat against oilstone

   F. Hone chisel by moving it back and forth over entire surface of oilstone until burr cannot be felt

JOB SHEET #1

G. Turn chisel bevel side down; hone this side, maintaining a 25-degree to 30-degree angle

H. Continue honing both sides of chisel until burr cannot be detected on cutting edge of chisel

I. Clean area; clean tools and store properly

HAND TOOLS
UNIT I

JOB SHEET #2 — USE A HACKSAW

I. Tools and equipment

   A. Steel tape or folding rule

   B. Soapstone

   C. Bench vise with soft jaws

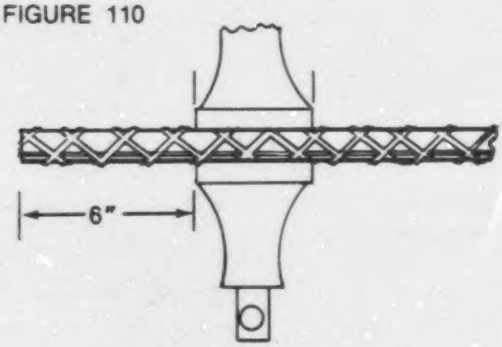
   D. Hacksaw

   E. One-inch reinforcing rod, 36 inches long

II. Procedure

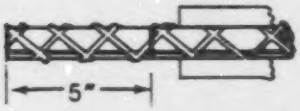
   A. Clamp reinforcing rod in bench vise so that about 6 inches extend past edge of vise (Figure 110)

FIGURE 110



   B. Use tape or rule to measure; mark a 5-inch length on rod with soapstone (Figure 111)

FIGURE 111

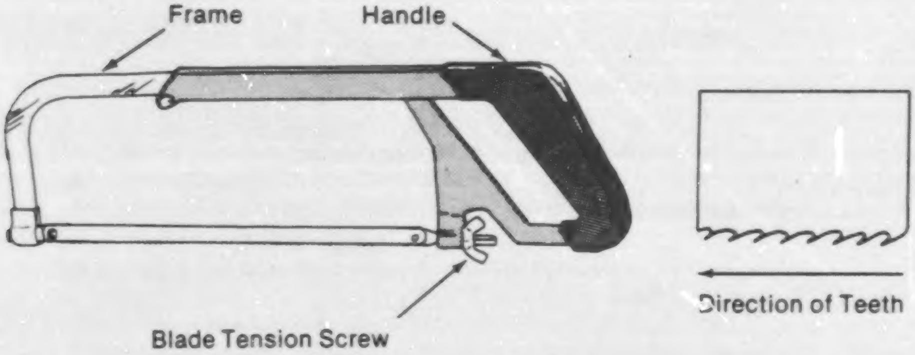


JOB SHEET #2

C. Check hacksaw to make sure that blade is tight, and that teeth are sharp and going in the right direction (Figure 112)

(NOTE: For most general-purpose work, use a blade that has twelve teeth per inch; however, a fine-tooth blade should be used to cut thin metal. When selecting saw blades, keep in mind the three-tooth rule—at least three teeth in contact with work.)

FIGURE 112



D. Put the saw blade on the soapstone mark

E. Hold the saw firmly by the handle and front of frame

F. Cut with a forward and back movement, making about forty strokes per minute; apply pressure on forward strokes, and lift saw slightly on return strokes

(NOTE: Cut on forward movement only, and use the entire length of blade.)

> **CAUTION**
>
> When the saw is about to cut through the stock, ease up on the pressure. Otherwise, you may push your hand into the sharp edge of the pipe still held in the vise.

G. Deburr cut end of both pieces of reinforcing rod

H. Put away tools and leftover rod; clean up work area

HAND TOOLS
UNIT I

JOB SHEET #4 — USE A LEVEL

I. Equipment and materials

   A. Four-foot spirit level

   B. Vertical and horizontal work surfaces

   C. Pencil

   D. Tape

   E. Straightedge

II. Procedure for leveling

   A. Check level for accuracy

   (NOTE: Levels are very delicate instruments and must be handled carefully to ensure accuracy. Levels should be checked for accuracy before use, especially if the instrument has been dropped or jarred.)

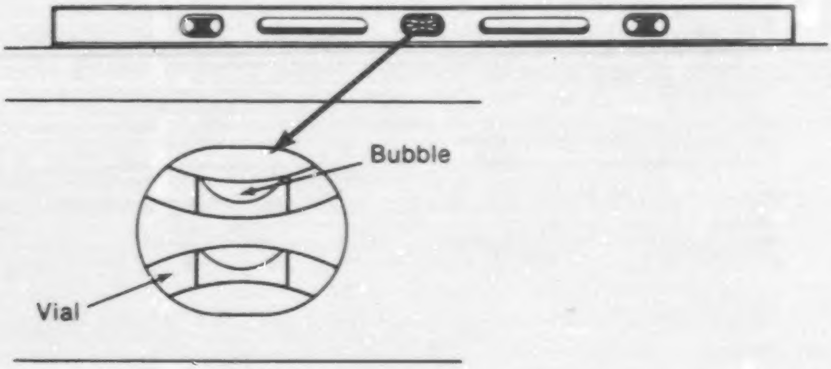
      1. Set base of level on flat, horizontal surface

      2. Check bubble position in horizontal vial

      3. Adjust surface or location of level until bubble is centered; mark position on surface

      (NOTE: On a level surface, the bubble will lie evenly positioned between the lines on the vial. See Figure 115.)

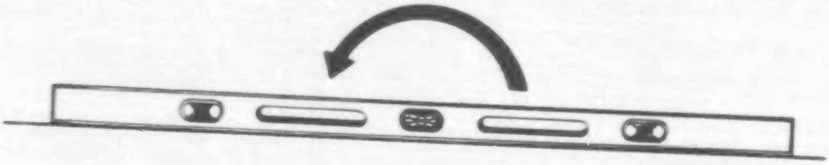
FIGURE 115



JOB SHEET #4

4. Rotate the level end for end and position it on the exact location of the bubble-centered reading (Figure 116)

FIGURE 116



5. Check bubble position in the horizontal vial

   (NOTE: The bubble will be centered from this side also if the level is accurate.)

6. Replace or repair level as necessary

B. Level a surface

1. Visually check surface for irregularities and foreign matter such as dirt

   (NOTE: Even small surface irregularities or particles can cause inaccurate readings.)

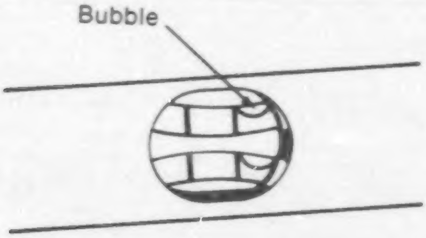
2. Clean or replace surface as necessary

3. Set base of level carefully and squarely on surface

4. Check bubble position

   (NOTE: The bubble will be displaced toward the high end of the level. See Figure 117.)

FIGURE 117



JOB SHEET #4

5. Adjust surface as necessary

6. Take additional readings to level surface as required

   (NOTE: Many factors, such as the type of surface and the material being used, affect the number of readings that are required.)

III. Procedure for plumbing

   A. Check level for accuracy

      1. Place base of level against flat, vertical surface (See Figure 118)

      2. Check bubble position in upper horizontal vial

      3. Adjust surface or location of level until bubble is centered; mark position on surface

      4. Rotate level end for end and position it on the exact location as that of the bubble-centered reading (Figure 119)

FIGURE 118

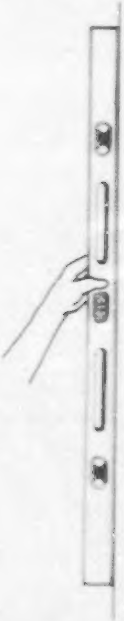
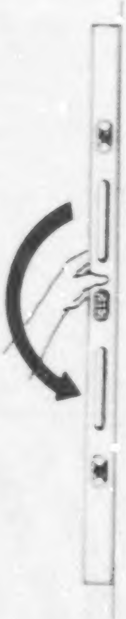


FIGURE 119



JOB SHEET #4

5. Check bubble position in the upper horizontal vial

   (NOTE: The bubble will be centered at this end also if level is accurate.)

6. Replace or repair level as necessary

B. Plumb a surface

1. Visually check surface for irregularities and foreign matter such as dirt

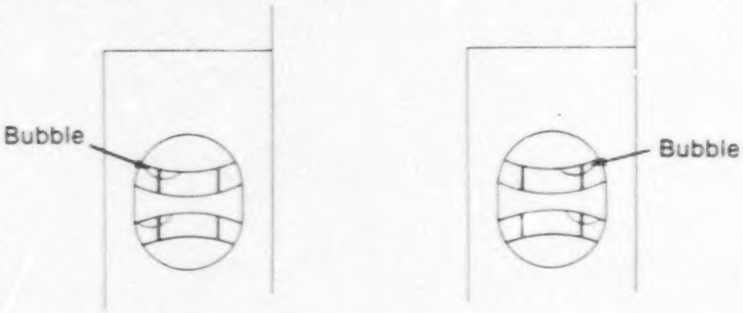
2. Clean or replace surface as necessary

3. Place base of level carefully and squarely against surface

4. Check bubble position in upper vial

   (NOTE: The bubble will move toward one end of the vial if the surface is not plumb. To plumb the surface, you must adjust it in the direction of bubble displacement. See Figure 120.)

FIGURE 120



Surface slants /

Surface slants \

5. Adjust surface as necessary

6. Take additional readings to plumb as required

C. Clean work area; put away tools and equipment

HAND TOOLS
UNIT I

JOB SHEET #3 — USE A FRAMING SQUARE AND RULE TO LAY OUT AN 8-INCH WALL CORNER

I. Equipment and materials

A. Framing square

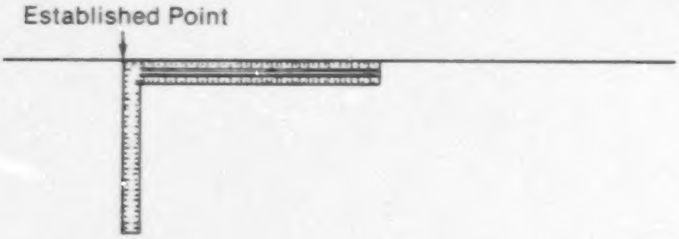
B. Pencil

C. Rule

II. Procedure

A. Use framing square to square off of an established point on a line (Figure 113)

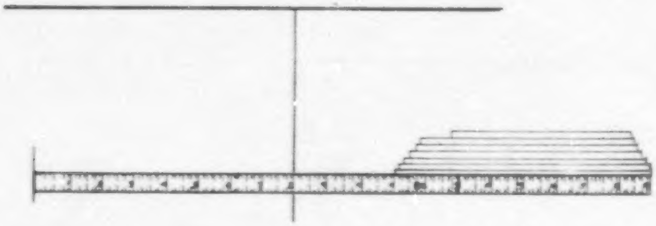
FIGURE 113



B. Mark line along edge of framing square to establish a square corner

C. Use rule to measure 8 inches from this line, and make a small mark (Figure 114)

FIGURE 114



JOB SHEET #3

D. Use framing square to square small mark with established line

E. Mark line along the edge of square

(NOTE: This establishes a square corner for an 8-inch wall.)

F. Recheck work

G. Put away tools and equipment

HAND TOOLS
UNIT I

JOB SHEET #5 — HAND TAP A HOLE IN A PIECE OF STEEL

I. Tools and equipment

  A. Drill chart

  B. Bench vise

  C. Soapstone

  D. Safety goggles

  E. Center punch

  F. Hammer

  G. Power drill motor

  H. Drill

  I. Tap wrench

  J. Tap

  K. Small square

  L. Cutting fluid

  M. Thread plug gauge

II. Procedure

  A. Determine size of thread from information given on drill chart

  B. Select proper tap drill size from information given on drill chart

  C. Mount piece of steel in vise

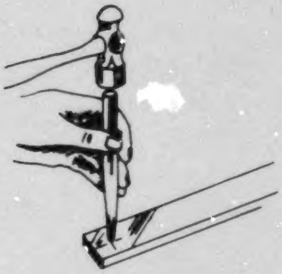
  D. Locate center of hole on steel; mark with soapstone

  E. Put on safety goggles

JOB SHEET #5

F. Use center punch and hammer to make a starting hole (Figure 121)

FIGURE 121



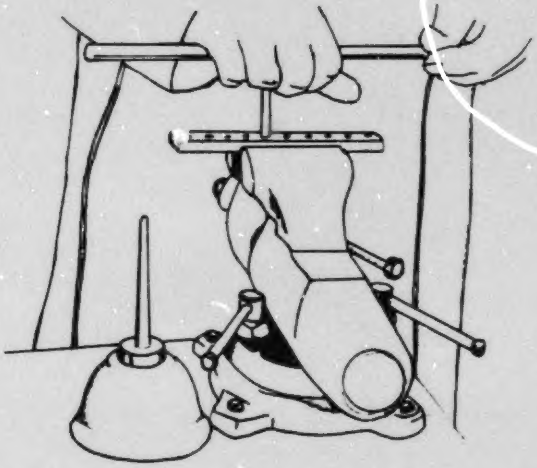
G. Select proper drill size for making hole

(NOTE: Instructor will perform actual drilling operation.)

H. Tighten tap in tap wrench

I. Cup hand over tap wrench and place tap in hole in steel; with tap parallel to hole, start turning to right, keeping downward pressure on tap; apply cutting fluid to the tap above the steel as required (Figure 122)

FIGURE 122

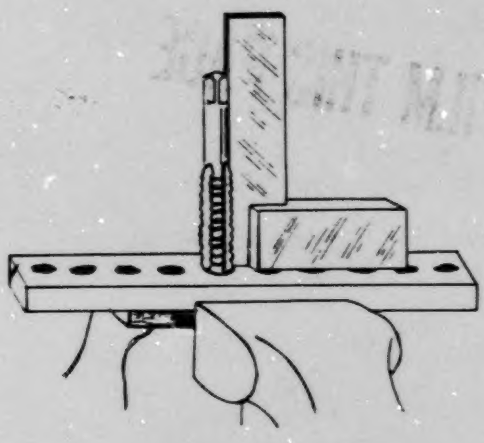


JOB SHEET #5

J. Remove tap wrench after a few threads have been cut, and check for squareness (Figure 123)

(NOTE: Use small square to check for squareness. Tap should be at 90-degree angle from the work in all positions. If tap is not square, you must start over; otherwise the thread and possibly the hole will be ruined.)

FIGURE 123



K. Reset tap wrench and continue turning and tapping hole until it is necessary to clean chips from hole

(NOTE: When using ordinary hand tap, after about three turns [or when tap gets hard to turn], reverse the tap one turn to break the chips. This will remove the chips and prevent damaging threads and tap. When tapping a blind hole, remove the tap and clean out the hole occasionally.)

L. Check thread with a thread plug gauge or with a bolt of correct dimensions

M. Take off safety goggles

N. Clean area; clean tools and store properly

HAND TOOLS
UNIT I

TEST

NAME ____ SCORE ________________

1. Match terms associated with hand tools to their correct definitions. Write the correct numbers in the blanks.

_____a. Strip of wood, plastic, or metal used for decorative purposes

_____b. Device for guiding a backsaw at the proper angle for cutting a miter joint in wood

_____c. Place where two or more surfaces meet

_____d. Cut made at an angle for joining two pieces of wood so that they will form an angle

_____e. Soft stone having a soapy feel; used for marking metal

_____f. Instrument for laying out angles

_____g. To sharpen with a whetstone or oilstone

_____h. Ornamental pattern

_____i. Instrument for marking and checking angles

1. Hone
2. Soapstone
3. Molding
4. Miter box
5. Miter
6. Joint
7. Fret
8. Protractor
9. Try miter

2. State seven guidelines for care and safe use of hand tools.

a. ____

b. ____

c. ____

d. ____

e. ____

f. ____

g. ____

TEST

3. Select from the following list hand tools a beginning carpenter needs. Write an "X" in the blank before each correct answer.

______a. Hand brace and bit
______b. Pliers
______c. Hammer
______d. Level
______e. Square
______f. Standard screwdrivers
______g. Plane
______h. Handsaw
______i. Adjustable wrench
______j. Scratch awl
______k. Hacksaw
______l. Rule or tape
______m. Phillips screwdrivers
______n. File
______o. Chalk line
______p. Combination set
______q. Fret
______r. Draw knife
______s. Chisel
______t. Utility knife
______u. Bow saw
______v. Ripping or pry bar
______w. One-hundred-foot tape
______x. Magnetic nail driver

4. Match types of hammers to their correct uses. Write the correct numbers in the blanks.

______a. Used to drive nails, pull nails, dismantle, and wreck
______b. Used to drive and pull nails
______c. Used to drive stakes and break concrete

1. Sledgehammer
2. Curved-claw hammer
3. Straight-claw hammer

5. Match types of handsaws to their correct uses. Write the correct numbers in the blanks. Handsaws and their uses continue on the next page.

______a. Used to cut curves and to shape ends of molding and trim for joints
______b. Used to cut across the grain of wood
______c. Used to cut fine joints; also used in a miter box to cut miters or square ends

1. Backsaw (miter-box saw)
2. Coping saw
3. Crosscut saw

TEST

______d. Used to cut metal

______e. Used to cut with the grain of wood

______f. Used to cut inside corners, curves, circles, and frets

______g. Used to cut smoothest possible joints (tenons, mortises, etc.)

4. Hacksaw
5. Dovetail saw
6. Compass saw (keyhole saw)
7. Ripsaw

6. Match types of squares to their correct uses. Write the correct numbers in the blanks.

______a. Used to measure and check 45-degree and 90-degree angles

______b. Used in general framing to lay out walls, partitions, rafters, braces, and stairs

______c. Used to measure or transfer angles from 0 degree to 180 degrees and to check miter cuts

______d. Used to check squareness and to mark 45-degree miters

______e. Used to mark and check angles

1. Framing square (rafter square)
2. Combination square
3. Try square
4. Sliding T-bevel
5. Speed square

7. Match types of planes to their correct uses. Write the correct numbers in the blanks.

______a. Used to plane small work to a smooth and even surface without taking off too much material

______b. Used to plane and true long boards such as edges of wood doors

______c. Used to plane rough work to produce a fairly smooth surface

______d. Used to plane small pieces, edges, joint surfaces, and grain or cross grain when a small amount of change is required

1. Jack plane
2. Block plane
3. Smoothing plane
4. Jointer plane

8. Match types of measuring instruments to their correct uses. Write the correct numbers in the blanks.

______a. Used to measure irregular as well as regular shapes and to make accurate inside measurements

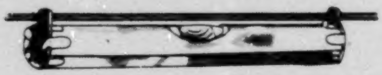
______b. Used to make accurate inside measurements

1. Folding rule (zigzag rule)
2. Flexible steel tape

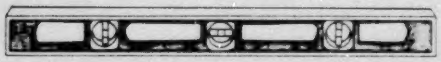
TEST

9. Identify the types of layout instruments illustrated below. Write the correct names in the blanks. Illustrations continue on the next page.

Spirit level
Builder's level
Torpedo level
Line level
Water level
Laser-beam level
Plumb bob



a. ____________________



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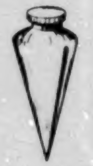

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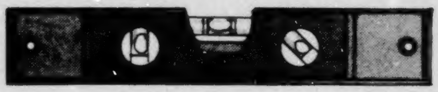

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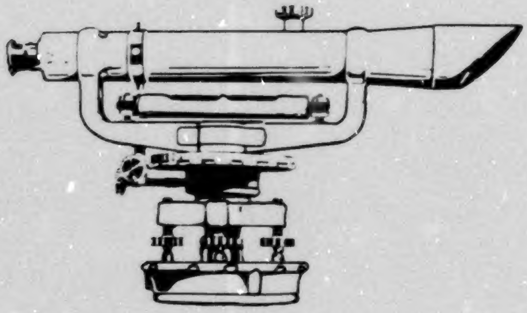

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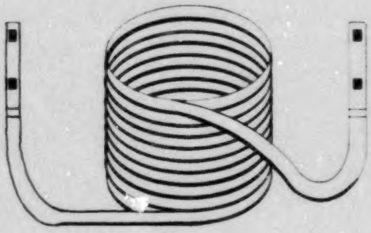

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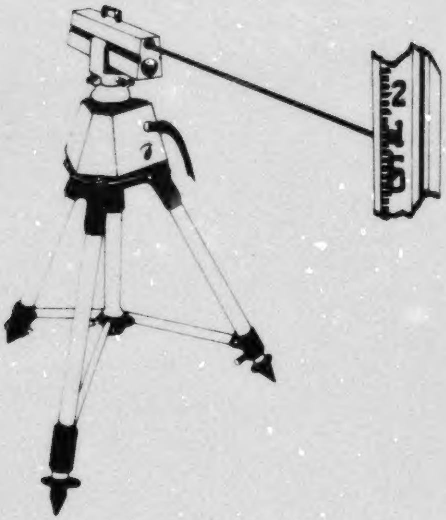
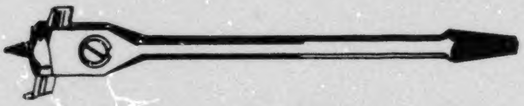


g. ________________________________

10. Identify the types of boring and drilling hand tools illustrated below. Write the correct names in the blanks. Illustrations continue on the next page.

Hand brace
Power bit (flat bit, speed bit)
Expansive bit (expansion bit)
Auger bit
Hand drill (eggbeater)
Twist drill (spiral drill)
Lockset bit
Push drill (automatic drill)
Hole saw



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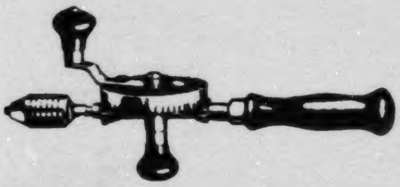

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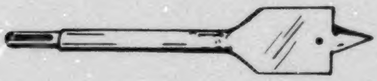

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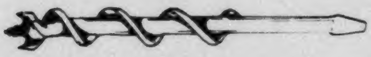

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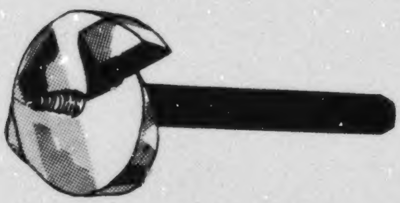

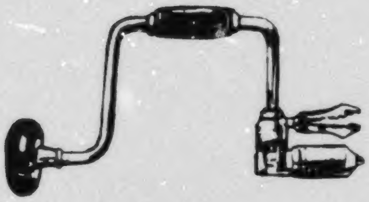

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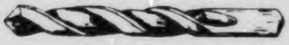

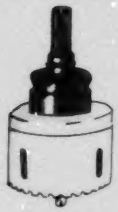

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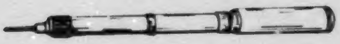
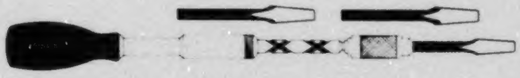


h. ______________________________ i. ______________________________

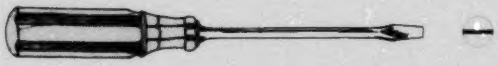
11. Identify the types of screwdrivers illustrated below. Write the correct names in the blanks. Illustrations continue on the next page.

Torx-head screwdriver
Standard screwdriver
  (flat-blade screwdriver)
Clutch-head screwdriver
Phillips screwdriver
Standard screwdriver bit
Standard offset screwdriver

Spiral ratchet screwdriver
  (automatic screwdriver)
Square-head screwdriver
  (Robertson screwdriver)
Phillips offset screwdriver
Phillips screwdriver bit



a. ______________________________



b. ______________________________

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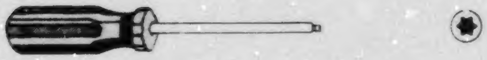

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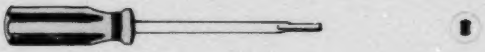
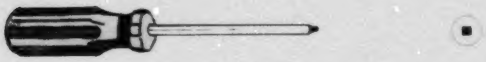


d. ______________________________



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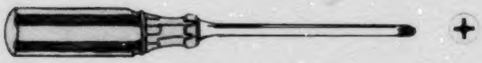

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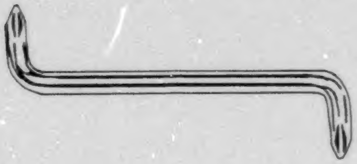

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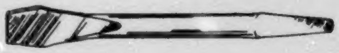
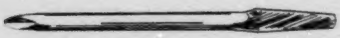
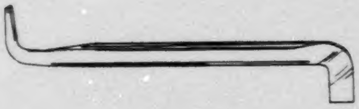


h. ______________________________



i. ______________________________



j. ______________________________

TEST

12. Match types of pliers to their correct uses. Write the correct numbers in the blanks.

_____a. Used to hold and turn small round parts

_____b. Used to hold and turn large round parts

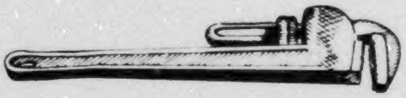
_____c. Used to hold and bend thin wire and metal fittings and to hold small objects in tight places

_____d. Used to hold, bend, shape, and cut wire

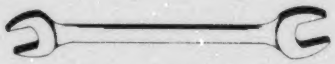
1. Channel-lock pliers
2. Combination slip-joint pliers
3. Needle-nose pliers
4. Side-cutting pliers

13. Identify the types of wrenches illustrated below. Write the correct names in the blanks.

Open-end wrench
Box-end wrench
Combination wrench
Adjustable wrench
Pipe wrench
Allen wrench (hex-key wrench)
Ratchet wrench and socket



a. ______________________________



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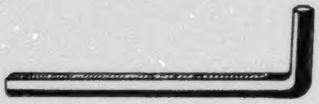

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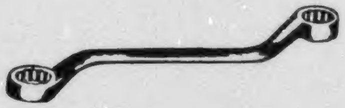

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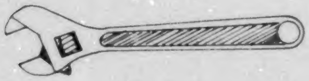
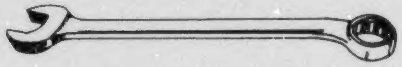


e. ______________________________



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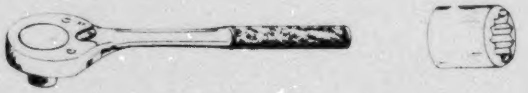
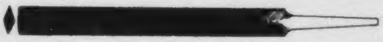


g. ______________________________

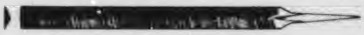
TEST

14. Identify the types of files illustrated below. Write the correct names in the blanks. Illustrations continue on the next page.

Cant saw
Half-round
Slitting
Round
Square
Flat
Knife
Triangular (three-square)



a. ______________________



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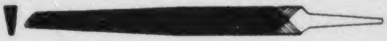
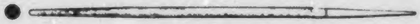
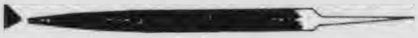


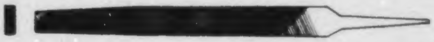
c. ______________________



d. ______________________



e. ______________________



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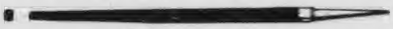

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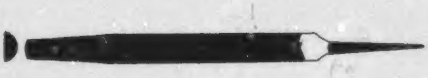
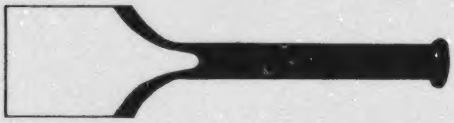


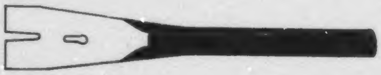
h. ____________________

15. Identify the types of chisels illustrated below. Write the correct names in the blanks.

Wood chisel
Cold chisel
Brick chisel
Stripping chisel
Floor chisel (straight-blade chisel)
Ripping chisel



a. ____________________



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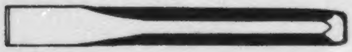
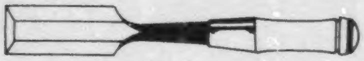
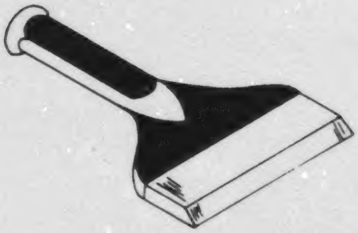


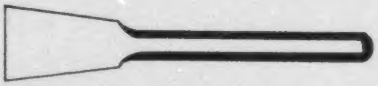
c. ____________________



d. ____________________



e. ____________________

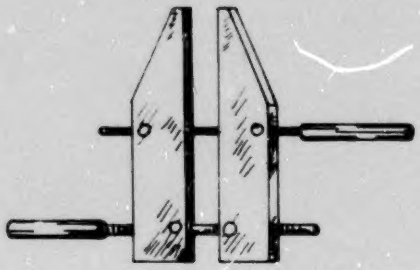


f. ____________________

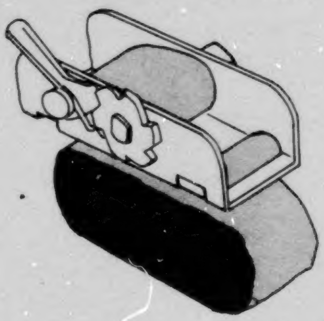
TEST

16. Identify the types of clamps illustrated below. Write the correct names in the blanks.

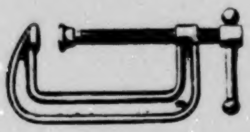
Bar clamp
C-clamp
Hand-screw clamp
Locking C-clamp
Spring clamp
Web clamp (strap clamp)



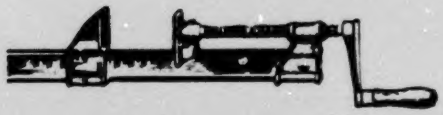
a. ______________________________



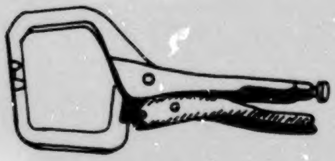
b. ______________________________



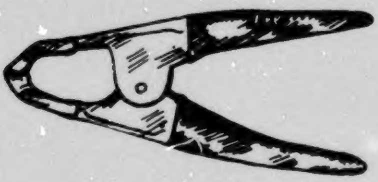
c. ______________________________



d. ______________________________



e. ______________________________

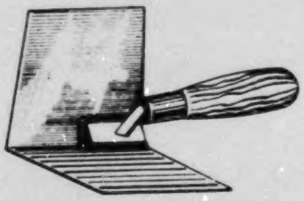


f. ______________________________

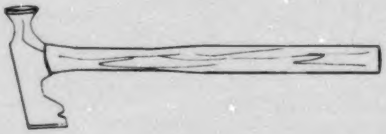
TEST

17. Identify the following hand tools used to install drywall. Write the correct names in the blanks.

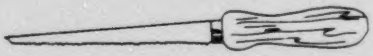
Outside-corner tool
Wallboard saw
Drywall T-square
Mud pan
Taping machine (banjo)
Drywall lifter
Taping knife
Long-handled sander
Inside-corner tool
Hand sander
Elastic knife
Drywall hammer
Utility saw
Trowel



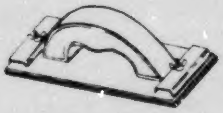
a. ______________________



b. ______________________



c. ______________________



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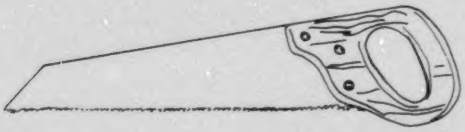
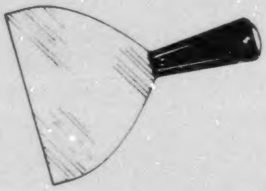
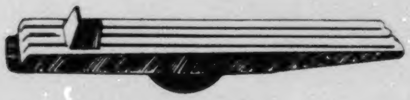


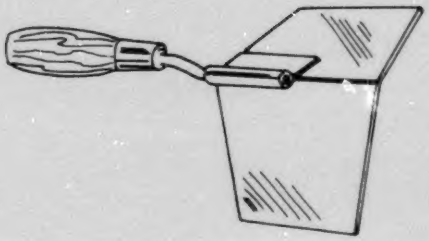
e. ______________________



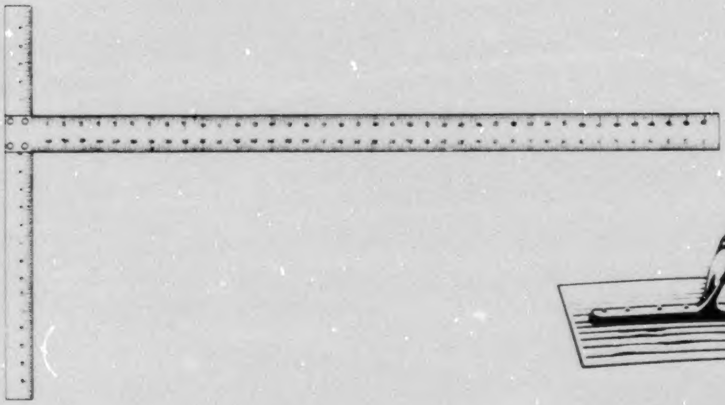
f. ______________________

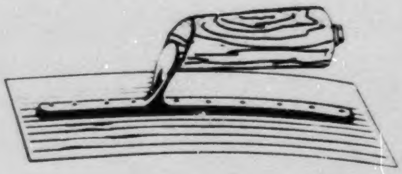
TEST



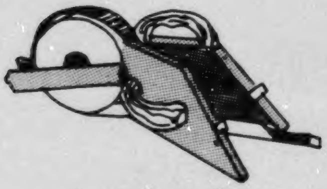


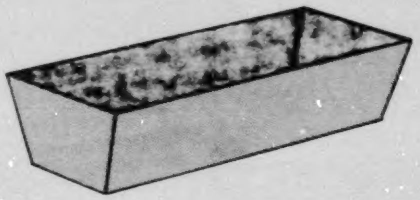
g. ______________________________ h. ______________________________





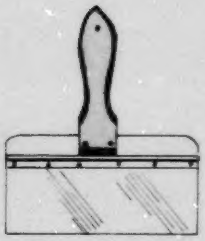
i. ______________________________ j. ______________________________

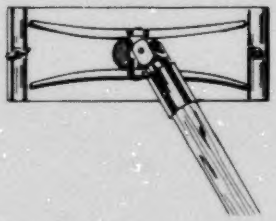




k. ______________________________ l. ______________________________

TEST





m. ______________________________ n. ______________________________

18. Match types of miscellaneous hand tools to their correct uses. Write the correct numbers in the blanks.

_____a. Used to shape and finish wood

_____b. Used to mark for position and thickness of the butt hinges on doors and door casings, and to mark location of lock plates and strike plates

_____c. Used to hone the final keen edge on tools with cutting edges

_____d. Used to pull nails

_____e. Used to scrape and apply putty and wood fillers

_____f. Used to sink a nail below the surface

_____g. Used to cut lightweight metal

_____h. Used to lay out an arc or circle, to step off measurements, and to divide distances along a straight line

_____i. Used to hold a workpiece while planing or trimming

_____j. Used to form an internal screw thread

_____k. Used with a framing square to lay out correct angle of riser height and tread run for each step on stair carriage

1. Divider and scribe
2. Nail set
3. Tin snips
4. Putty knife
5. Nail claw
6. Oilstone
7. Butt gauge
8. Wood rasp
9. Woodworker's vise
10. Tap and tap wrench
11. Stair gauge

TEST

(NOTE: Test question 19 lists the job sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

19. Demonstrate the ability to

    a. Hone a wood chisel.

    b. Use a hacksaw.

    c. Use a framing square and rule to lay out an 8-inch wall corner.

    d. Use a level.

    e. Hand tap a hole in a piece of steel.

HAND TOOLS
UNIT I

ANSWERS TO TEST

1. a. 3
   b. 4
   c. 6
   d. 5
   e. 2
   f. 8
   g. 1
   h. 7
   i. 9

2. Answers should include any seven of the following

   a. Use the correct tool for the job
   b. Keep tools sharp
   c. Keep tools clean
   d. Inspect tools frequently to make sure they are in good condition
   e. Repair broken or damaged tools promptly
   f. Dispose of broken or damaged tools that cannot be repaired
   g. Store tools properly when not in use
   h. Stay alert when using tools
   i. Wear eye protection when necessary

3. a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, s, t, v, w

4. a. 3
   b. 2
   c. 1

5. a. 2
   b. 3
   c. 1
   d. 4
   e 7
   f. 6
   g. 5

6. a. 3
   b. 1
   c. 4
   d. 2
   e. 5

7. a. 3
   b. 4
   c. 1
   d. 2

8. a. 2
   b. 1

9. a. Line level
   b. Spirit level
   c. Plumb bob
   d. Torpedo level
   e. Builder's level
   f. Water level
   g. Laser-beam level

10. a. Expansive bit (expansion bit)
    b. Hand drill (eggbeater)
    c. Power bit (flat bit, speed bit)

ANSWERS TO TEST

d. Auger bit
e. Lockset bit
f. Hand brace
g. Twist drill (spiral drill)
h. Push drill (automatic drill)
i. Hole saw

11. a. Spiral ratchet screwdriver (automatic screwdriver)
b. Standard screwdriver (flat-blade screwdriver)
c. Torx-head screwdriver
d. Clutch-head screwdriver
e. Square-head screwdriver (Robertson screwdriver)
f. Phillips screwdriver
g. Phillips offset screwdriver
h. Standard screwdriver bit
i. Phillips screwdriver bit
j. Standard offset screwdriver

12. a. 2
b. 1
c. 3
d. 4

13. a. Pipe wrench
b. Open-end wrench
c. Allen wrench (hex-key wrench)
d. Box-end wrench
e. Adjustable wrench
f. Combination wrench
g. Ratchet wrench and socket

14. a. Slitting
b. Cant saw
c. Knife
d. Round
e. Triangular (three-square)
f. Flat
g. Square
h. Half-round

15. a. Stripping chisel
b. Ripping chisel
c. Cold chisel
d. Wood chisel
e. Brick chisel
f. Floor chisel (straight-blade chisel)

16. a. Hand-screw clamp
b. Web clamp (strap clamp)
c. C-clamp
d. Bar clamp
e. Locking C-clamp
f. Spring clamp

17. a. Inside-corner tool
b. Drywall hammer
c. Utility saw
d. Hand sander
e. Wallboard saw
f. Elastic knife
g. Drywall lifter
h. Outside-corner tool
i. Drywall T-square
j. Trowel
k. Taping machine (banjo)
l. Mud pan
m. Taping knife
n. Long-handled sander

ANSWERS TO TEST

18. a. 8
    b. 7
    c. 6
    d. 5
    e. 4
    f. 2
    g. 3
    h. 1
    i. 9
    j. 10
    k. 11

19. Performance skills evaluated to the satisfaction of the instructor

POWER TOOLS
UNIT II

UNIT OBJECTIVE

After completing this unit, the student should be able to identify power tools used by carpenters and match the tools to their correct uses. The student should also be able to demonstrate safe and proper use of various power tools. The student will show this knowledge by completing job sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match to their correct definitions terms associated with power tools.
2. State general safety rules pertaining to power tools.
3. Select from a list general guidelines for proper care of power tools.
4. Select from a list uses of a table saw.
5. State rules for safe use of tables saws.
6. Select from a list uses of a radial arm saw.
7. State rules for safe use of radial arm saws.
8. Select from a list uses of a jointer.
9. State rules for safe use of jointers.
10. Select from a list uses of a power plane.
11. State rules for safe use of power planes.
12. Select from a list uses of a shaper.
13. State rules for safe use of shapers.
14. Select from a list uses of a table band saw.
15. State rules for safe use of table band saws.
16. Select from a list uses of a bench grinder.
17. State rules for safe use of bench grinders.

OBJECTIVE SHEET

18. Select from a list uses of a drill press.
19. State rules for safe use of drill presses.
20. Select from a list uses of a combination belt-and-disc sander.
21. State rules for safe use of combination belt-and-disc sanders.
22. Select from a list uses of a power miter saw.
23. State rules for safe use of power miter saws.
24. Select from a list uses of a sawbuck.
25. State rules for safe use of sawbucks.
26. Distinguish between uses of a portable angle grinder and a belt sander.
27. State rules for safe use of portable angle grinders and belt sanders.
28. Distinguish among uses of portable power saws.
29. State rules for safe use of portable power saws.
30. Distinguish between uses of a router and a trimmer.
31. State rules for safe use of routers and trimmers.
32. Distinguish among uses of a portable drill, screwdriver, and hammer drill.
33. State rules for safe use of portable drills, screwdrivers, and hammer drills.
34. Select from a list uses of a portable power plane.
35. State rules for safe use of portable power planes.
36. Distinguish between uses of a rotary hammer and a chipping hammer.
37. State rules for safe use of rotary and chipping hammers.
38. Select from a list uses of metal shears.
39. State rules for safe use of metal shears.
40. Distinguish between uses of pneumatic fasteners.
41. State rules for safe use of pneumatic fasteners.
42. Identify the parts of a powder-actuated tool.

OBJECTIVE SHEET

43. Select from a list uses of a powder-actuated tool.

44. State rules for safe use of powder-actuated tools.

45. Match circular-saw blades to their correct uses.

46. Complete a safety test for specific tools.

47. Demonstrate the ability to

    a. Perform straight and angle cut-off operations.

    b. Perform ripping operations.

    c. Make miter and compound miter cuts.

    d. Operate a power sander.

    e. Drill and bore holes.

    f. Perform jointing operations.

    g. Perform face-planing operation.

    h. Perform edge-shaping operation.

    i. Operate a pneumatic fastener.

    j. Safely load and use a powder-actuated tool.

POWER TOOLS
UNIT II

SUGGESTED ACTIVITIES

I. Instructional materials

   A. Objective sheet

   B. Suggested activities

   C. Supplement #1 — Power Tool Crossword Puzzle

   D. Information sheet

   E. Assignment Sheet #1 — Complete a Safety Test for Specific Tools

   F. Answers to assignment sheet

   G. Job sheets

      1. Job Sheet #1 — Perform Straight and Angle Cut-Off Operations
      2. Job Sheet #2 — Perform Ripping Operations
      3. Job Sheet #3 — Make Miter and Compound Miter Cuts
      4. Job Sheet #4 — Operate a Power Sander
      5. Job Sheet #5 — Drill and Bore Holes
      6. Job Sheet #6 — Perform Jointing Operations
      7. Job Sheet #7 — Perform Face-Planing Operation
      8. Job Sheet #8 — Perform Edge-Shaping Operation
      9. Job Sheet #9 — Operate a Pneumatic Fastener
      10. Job Sheet #10 — Safely Load and Use a Powder-Actuated Tool

   H. Test

   I. Answers to test

II. Instructor's guide

   A. Review unit and plan presentation.

   (NOTE: This unit has been designed to allow you a great deal of flexibility in presenting the material. In the information sheet, the safety rules and uses for each tool are grouped together by tool. The safety test assignment sheet and

SUGGESTED ACTIVITIES

the unit test can be given in parts to cover just the tool or tools that you are interested in teaching or evaluating. The job sheets are built around operations, thus giving you a choice of teaching techniques. For example, Job Sheet #1 tells how to perform cut-off operations using a table saw, a radial arm saw, a circular saw, a jigsaw, and a band saw. Similarly, Job Sheet #2 provides instructions for ripping with a variety of tools. In this way, you can teach either the procedure or the tool, or you can use a combination of those presentations. You will want to consider your students, your program, the time available, your shop facilities, your building project, and other factors in making those decisions.)

B. Obtain materials to supplement unit.

1. Films

   a. *Safety in the Shop: Power Tools.* Black and white, 13½ minutes, 1970. Available from Coronet Films, Inc., 65 E. Southwater Street, Chicago, Illinois 60611.

   b. *On Every Hand.* Color, 10 minutes, 1970. Available from Journal Films, Inc., 930 Pitner Avenue, Evanston, Illinois 60202.

   (NOTE: The above films are available to Oklahoma teachers on a free-loan basis. Oklahoma teachers may order from the State Department of Vocational and Technical Education, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074. Out-of-state teachers must order from the addresses listed with the films.)

2. Poster of safety rules for each stationary tool

3. Accident report forms

4. Equipment and materials for job sheet tasks and illustration of terms

5. Competency profiles

   (NOTE: Competency profiles are available from the State Department of Vocational and Technical Education, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074, or from The Associated General Contractors of America, 1957 E Street, N.W., Washington, D.C. 20006; phone 202-393-2040.)

C. Introduce the unit, empahsizing the convenience of power tools while stressing the fact that the use of power tools places on the student an even greater responsibility to be careful.

SUGGESTIONS:

- Tour the shop area, pointing out tools that the students will be studying and demonstrating uses of those tools.

SUGGESTED ACTIVITIES

- Stage a contest pitting yourself against a group of students or against a volunteer challenger to see who can cut off a 2×4 fastest; provide the student or students with handsaws; after they have started sawing, use a power saw to quickly cut your 2×4; reinforce the demonstration by pointing out that your chances of sustaining a serious injury were much greater than theirs and that if you had been injured, you probably would not have finished first.

D. Provide students with unit.

E. Discuss unit and specific objectives, emphasizing the methods you will use to cover the unit.

F. Discuss information, assignment, and job sheets.

1. Use Information Sheet, Section I to discuss terms associated with power tools; use actual examples of tools and accessories discussed and of wood tooled in the ways listed.

2. Use Information Sheet, Section II to discuss general safety precautions that must be followed when using power tools.

   SUGGESTIONS:

   - Show safety films.
   - Post at tool station safety rules for each stationary tool.
   - Make a display of accident report forms and safety posters.
   - Have carpenters who have been seriously injured by power tools talk to the class about their accidents.

3. Use Information Sheet, Section III to discuss general guidelines for proper care of power tools.

   SUGGESTIONS:

   - Demonstrate the proper care of tools in general.
   - Display examples of tools that have been improperly cared for or abused.

4. Use the remaining sections of the information sheet to discuss the safety, care, and uses of each tool in accordance with your plan of presentation; use job sheets as required.

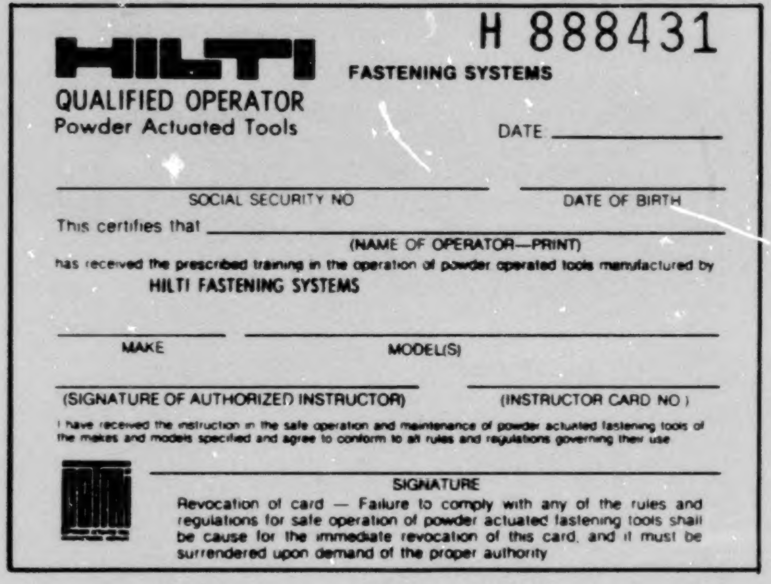
   (NOTE: We recommend that you present the material for a particular tool and require the student to correctly answer all the questions in Assignment Sheet #1 regarding that tool before allowing the student to use that particular tool.)

SUGGESTED ACTIVITIES

5. Have students complete training program offered by manufacturers of powder-actuated tools.

(NOTE: No one, student or teacher, should be allowed to operate a powder-actuated tool until he or she has been trained, certified, and issued a qualified operator's card. See example of operator's card below.)

EXAMPLE:



H 888431

HILTI FASTENING SYSTEMS

QUALIFIED OPERATOR
Powder Actuated Tools

DATE ____________

____________ SOCIAL SECURITY NO
____________ DATE OF BIRTH

This certifies that ____________ (NAME OF OPERATOR—PRINT)
has received the prescribed training in the operation of powder operated tools manufactured by
HILTI FASTENING SYSTEMS

____________ MAKE
____________ MODEL(S)

____________ (SIGNATURE OF AUTHORIZED INSTRUCTOR)
____________ (INSTRUCTOR CARD NO)

I have received the instruction in the safe operation and maintenance of powder actuated fastening tools of the makes and models specified and agree to conform to all rules and regulations governing their use

____________ SIGNATURE

Revocation of card — Failure to comply with any of the rules and regulations for safe operation of powder actuated fastening tools shall be cause for the immediate revocation of this card, and it must be surrendered upon demand of the proper authority

Used with permission of Hilti Fastening Systems, Tulsa, Oklahoma.

G. Review information sheet.

SUGGESTIONS:

- Have each student demonstrate correct operation of power tools, using other students to critique the performances.
- Use Assignment Sheet #1 to review unit.

H. Give test.

I. Critique test and discuss in class.

J. Reteach and retest as necessary.

K. Complete appropriate section of competency profiles.

SUGGESTED ACTIVITIES

III. Unit references

A. *Consumer Products 1979-1980,* Catalog 319. Towson, Maryland: Black & Decker (U.S.) Inc., 1980.

B. *DX350 Instructional Manual.* Tulsa, Oklahoma: Hilti Corporation, Hilti Fastening Systems, 1982.

C. *Heavy Duty Professional Power Tools and Accessories for Construction and Industry,* Catalog NPE-9. Hampstead, Maryland: Black & Decker Industrial/Construction Division, 1983.

D. Hendrix, Laborn J. "Bud." *Commercial Carpentry.* Stillwater, Oklahoma: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, and The Associated General Contractors of America, 1979.

E. *Instructional Manual Sawbuck Frame and Trim Saw,* Part No. 422-25-651-0003. Pittsburgh, Pennsylvania: Delta International Machinery Corp., 1984.

F. *Makita Tool Catalog.* Cerritos, California: Makita U.S.A. Inc., 1982.

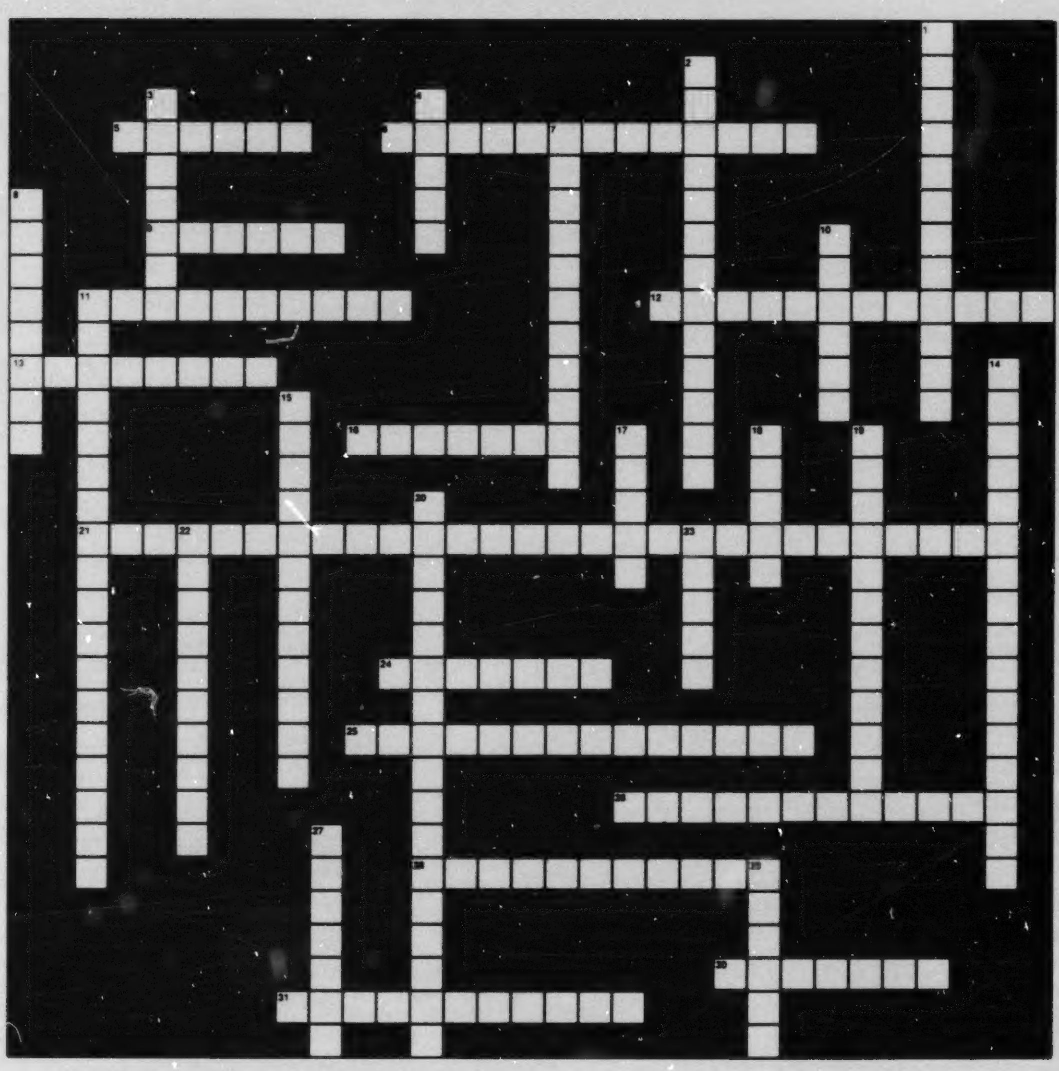
G. "Pneumatic Staplers and Nailers," Pamphlet AD 1584. East Greenwich, Rhode Island: Bostitch Division of Textron Inc., 1980.

H. *Rockwell Professional Power Tools,* Catalog No. AD-3700. Pittsburgh, Pennsylvania: Rockwell International Power Tool Division, 1980.

SUGGESTED ACTIVITIES

SUPPLEMENT #1 — POWER TOOL CROSSWORD PUZZLE

This crossword puzzle will help familiarize you with the different power tools and their uses. Complete the crossword puzzle below, using the clues on the following page.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SUPPLEMENT #1

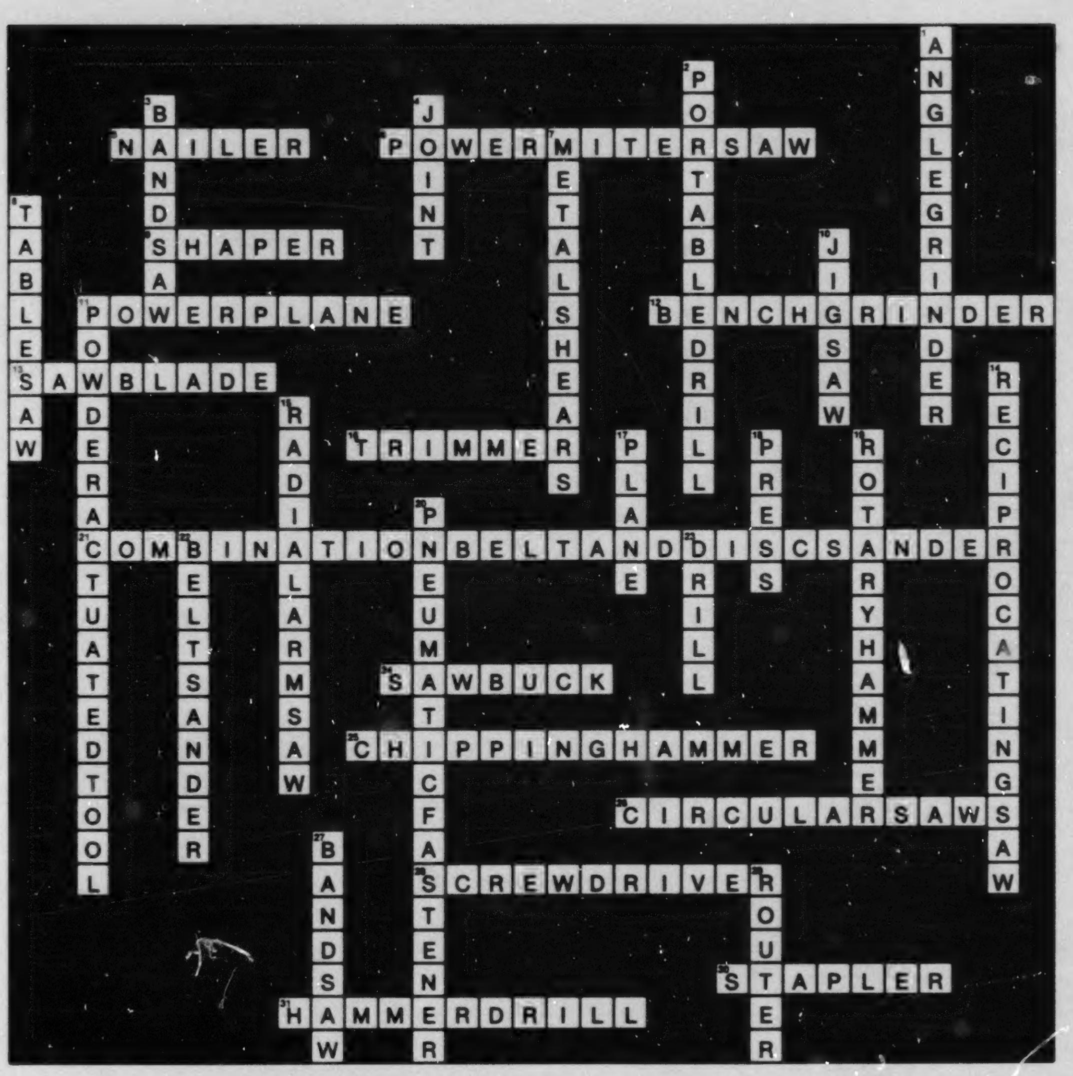
ACROSS

5. Used to apply sheathing and decking, and to install framing and finish work
6. Used to cut straight miters, and to crosscut (3 wds.)
9. Used to shape edges and moldings, and to groove, flute, and reed
11. Used to straighten material, face plane, edge plane, chamfer, bevel, taper, and rabbet (2 wds.)
12. Used to sharpen tools, to grind and shape steel, and to grind off burrs and rough places from steel (2 wds.)
13. Cutting accessory used on table saw, radial arm saw, and portable circular saws (2 wds.)
16. Used to cut laminate, bevel trim, flush trim, and to cut obtuse and acute angles
21. Used for rough and fine sanding, shaping, and grinding glass (5 wds.)
24. Used to cut straight miters, crosscut, and bevel cut, and to cut compound miters
25. Used to chip concrete and masonry, and to bushhammer concrete (2 wds.)
26. Used to rip, crosscut, and miter, and to cut pockets and bevels (2 wds; pl.)
28. Used to drive and remove wood screws, machine screws, thread-cutting screws, and lag bolts
30. Used to apply sheathing, decking, and roofing, and to install insulation, ceiling tile, and paneling
31. Used to drill holes in masonry, concrete, wood, and other materials, and to set anchors; also used for light chipping and for mixing materials (2 wds.)

DOWN

1. Used to rough sand, grind metal and concrete, polish and buff, wire brush, and remove rust and scale from steel (2 wds.)
2. Used to drill, bore, cut holes with hole saw, mix materials, and drive screws (2 wds.)
3. Used to make irregular cuts and relief cuts, to saw circles, and to resaw (2 wds.)
4. The place where two or more surfaces meet
7. Used to cut sheet metal, metal straps, and special lightweight materials
8. Used to rip, crosscut, miter, rabbet, dado, and cut moldings (2 wds.)
10. Used to rip and crosscut, to cut curves, scrolls, inside curves, and corners, and to make pocket cuts and relief cuts
11. Used to drive pins and threaded studs; to fasten wood to concrete, masonry, and steel; to fasten steel to steel; and to fasten steel to concrete (3 wds.)
14. Used for making irregular cuts, inside curves, corner, pocket, and relief cuts; and for crosscutting (2 wds.)
15. Used to rip, crosscut, miter, rabbet, dado, and cut moldings (3 wds.)
17. Portable tool used to straighten material, face plane, edge plane, chamfer, and bevel
18. With 23 Down, used to drill, bore, shape, tap, sand, mortise, grind, and cut holes with a hole saw
19. Used to drill holes in masonry and concrete, to set anchors, and to perform light chipping (2 wds.)
20. Nailer or stapler used for applying sheathing, decking, roofing, insulation, ceiling tile, and paneling (2 wds.)
22. Used for rough and smooth sanding, and for grinding glass (2 wds.)
23. See 18 Down
27. Portable saw used to cut metal studs, angle iron, steel pipe, and steel rods
29. Used for edge shaping, rabbeting, dadoing, fluting, reeding, dovetailing, beveling, and mortising

SOLUTION TO SUPPLEMENT #1


1 ANGLEGRINDER
2 PORTABLEDRILL
3 BANDSAW
4 JOINT
5 NAILER
6 POWERMITERSAW
7 METALSHEARS
8 TABLESAW
9 SHAPER
10 JIGSAW
11 POWERPLANE
11 POWDERACTUATEDTOOL
12 BENCHGRINDER
13 SAWBLADE
14 RECIPROCATINGSAW
15 RADIALARMSAW
16 TRIMMER
17 PLANE
18 PRESS
19 ROTARYHAMMER
20 PNEUMATICFASTENER
21 COMBINATIONBELTANDDISCSANDER
22 BELTSANDER
23 DRILL
24 SAWBUCK
25 CHIPPINGHAMMER
26 CIRCULARSAWS
27 BANDSAW
28 SCREWDRIVER
29 ROUTER
30 STAPLER
31 HAMMERDRILL

POWER TOOLS
UNIT II

INFORMATION SHEET

I. Terms and definitions

   A. Bevel — Slant or inclination on a surface

   B. Chamfer — Edge of board beveled at 45-degree angle; may be angular or curved

   C. Dado — Rabbet or groove cut in wood

   D. Rabbet — Groove cut in surface or edge of a board to receive another board similarly cut

   E. Dovetail — Interlocking joint

   F. Flute — Concave channel or groove cut into wood

   G. Mortise — Cutout area or depression made to receive something such as hinges on doors

   H. Relief cut — Cut in stock that keeps blade from binding

   I. Reeding — Type of molding made by cutting or routing close-spaced, parallel, half-round, convex profiles; process of cutting or routing such profiles

   J. Resawing — Cutting thick pieces of stock to make two or more thinner pieces

   K. Pocket cut — Interior cut that removes a middle section of stock

   L. Kickback — Sharp, violent reaction of tool as it rejects material being forced into it

   M. Drive pin — Fastener used in a powder-actuated tool

   N. Booster — Powder load used to project fasteners in powder-actuated tools

   O. Push stick — Safety device used to push material through cutters to protect fingers from being cut

   P. Door jack — Holder or stand used to hold door on edge while planing, routing, or installing hinges

II. General safety rules pertaining to power tools

   (NOTE: Power tools may be operated by electricity [AC or DC current], air, combustion engines, or explosive powder.)

   A. Do not attempt to operate any power tool before being checked out by instructor on that particular tool

INFORMATION SHEET

B. Always wear eye protection and hard hat when operating a power tool

C. Wear appropriate clothing for job being done

(NOTE: Always wear tight-fitting clothing that cannot become caught in the moving tool. Roll up long sleeves, tuck in shirttails, and tie back long hair.)

D. Do not distract others or let anyone distract you while operating a power tool

E. Do not leave power tool running unattended

F. Assume a safe and comfortable position before using a power tool

G. Be sure that power tool is properly grounded before using

H. Be sure that power tool is disconnected before performing maintenance or changing accessories

I. Do not use dull or broken tool or accessories

J. Use a power tool only for its intended use

K. Keep feet, fingers, and hair away from the blade and other moving parts of a power tool

L. Do not use a power tool with guards or safety devices removed

M. Do not operate a power tool if hands or feet are wet

N. Keep work area clean at all times

O. Before attempting to use it, be familiar with the correct operation and adjustments of power tool

P. Keep a firm grip on the power tool at all times

Q. Use electric extension cords of sufficient size to service particular power tool you are using

III. General guidelines for proper care of power tools

A. Keep tools clean and in good working order

B. Keep machine surfaces clean and waxed

C. Follow manufacturer's maintenance procedures

D. Protect cutting edges

INFORMATION SHEET

E. Keep all tool accessories, such as blades and bits, sharp

F. Always use appropriate blade for the arbor size

G. Report any unusual noises, sounds, or vibrations to the instructor or supervisor

H. Inspect tools and accessories regularly

I. Keep tools in their proper place when not in use

IV. Uses of a table saw (Figure 1)

A. Ripping

B. Crosscutting

C. Mitering

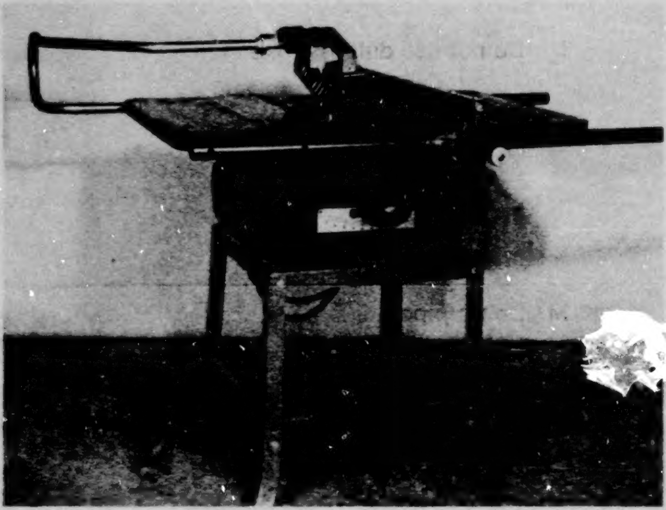
D. Rabbeting

E. Dadoing

F. Cutting molding

EXAMPLE:

FIGURE 1



V. Rules for safe use of table saws

A. Keep guard over blade while machine is being used

B. Do not stand directly in line with blade

C. Make sure that blade does not project more than 1/8 inch above stock being cut

D. Never reach across saw blade

E. Use a push stick for ripping all stock less than 4 inches wide

INFORMATION SHEET

F. Enlist a helper to support long or wide stock

(NOTE: The weight of the stock may cause the table to lean.)

G. Before cutting stock to length using miter gauge and rip fence, clamp on a step block for clearance

H. Do not rip without rip fence, or crosscut without miter gauge

I. When blade is tilted, be sure that blade will clear stock before turning on machine

J. Be sure that stock has a straight edge before ripping

K. Do not rip cylindrical stock on a circular saw

L. When using a dado or molding head, take extra care to hold stock firmly

M. Use proper blade for the job being done

VI. Uses of a radial arm saw (Figure 2)

A. Ripping

B. Crosscutting

C. Mitering

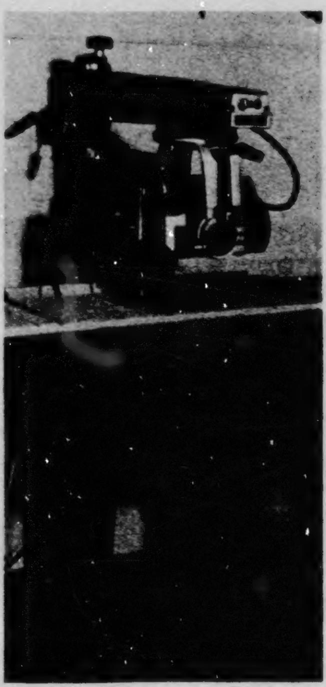
D. Rabbeting

E. Dadoing

F. Cutting molding

EXAMPLE:

FIGURE 2



INFORMATION SHEET

VII. Rules for safe use of radial arm saws

- A. Make sure that saw is set at proper depth before turning it on
- B. Use only a sharp and properly set blade
- C. Use the proper blade for the job being done
- D. Do not stand directly in line with blade
- E. Make sure that saw has attained maximum speed before starting the cut
- F. Do not let saw feed too fast when crosscutting heavy stock

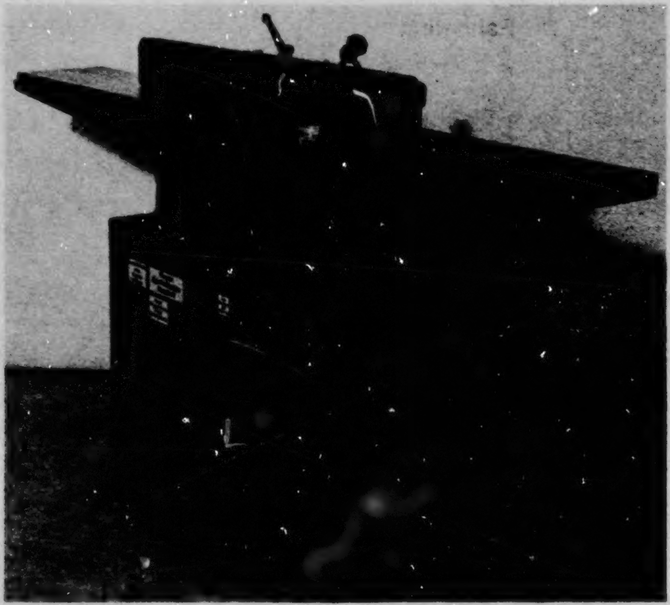
  (NOTE: The saw will have a tendency to feed itself.)
- G. When ripping, follow the same safety rules as those for using table saw
- H. Always use anitkickback guard when ripping
- I. Do not feed or pull stock too fast when ripping because this will jam the saw
- J. When ripping, feed stock against direction of blade rotation
- K. Do not stop blade by forcing scrap wood into blade

VIII. Uses of a jointer (Figure 3)

- A. Straightening
- B. Face planing
- C. Edge planing
- D. Beveling
- E. Chamfering
- F. Tapering
- G. Rabbeting

EXAMPLE:

FIGURE 3



INFORMATION SHEET

IX. Rules for safe use of jointers

A. Keep guard over knives at all times while operating jointer

B. Adjust depth of cut before power is turned on

C. Do not use stock less than 12 inches long

D. Do not use strips less than 1 inch wide

E. Use push stick or push block when jointing narrow or flat pieces of stock

F. Secure clamping screws tightly on fence so that fence will not slip while in use

G. Do not start the cut until jointer has gained its maximum speed

H. Keep fingers as high as possible on stock, and *never* drag thumb at back of stock

I. Avoid taking cuts deeper than 1/8 inch; too deep a cut can cause kickbacks

J. When passing work over jointer, change position of hands so that they will never be directly over knives

K. Follow through with stock and allow guard to return to closed position

L. Do not attempt to plane discs or other pieces that cannot be held securely against fence

X. Uses of a power plane (Figure 4)

A. Straightening

B. Face planing

C. Edge planing

D. Chamfering

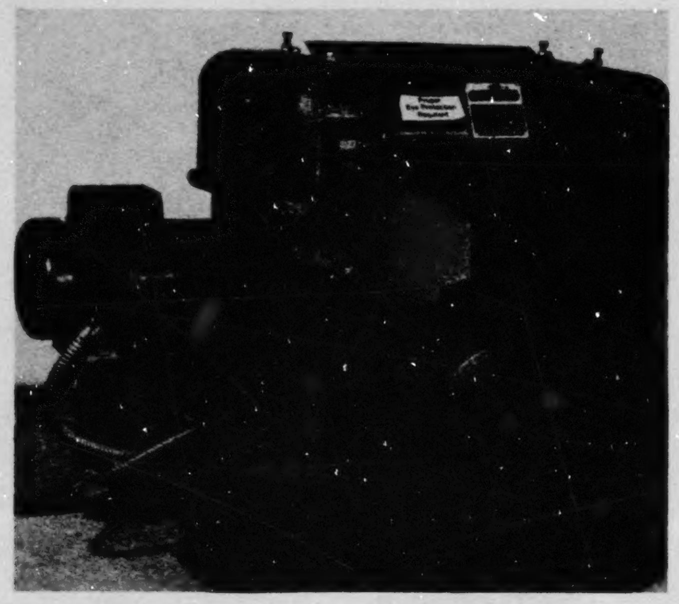
E. Beveling

F. Tapering

G. Rabbeting

EXAMPLE:

FIGURE 4



INFORMATION SHEET

XI. Rules for safe use of power planes

A. Keep hands clear of blades

B. Keep a firm grip on stock

C. Do not attempt to remove too much material with one cut

D. Make adjustments only after power has been disconnected

(NOTE: Make speed adjustment according to manufacturer's recommendation.)

E. Check stock to be sure that it is free of nails or other objects that may damage machine or be dangerous to operator

XII. Uses of a shaper (Figure 5)

A. Shaping edges

B. Shaping molding

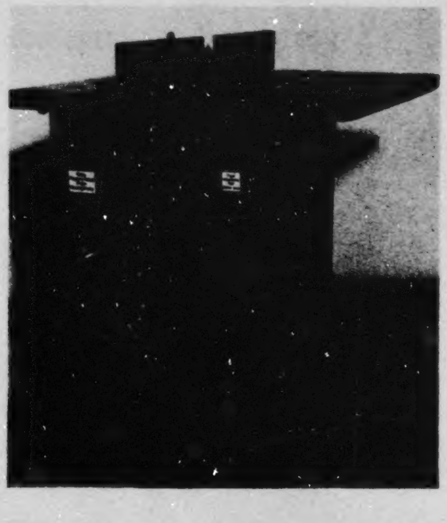
C. Grooving

D. Fluting

E. Reeding

EXAMPLE:

FIGURE 5



XIII. Rules for safe use of shapers

A. Whenever possible, install cutter so that bottom of stock is shaped; in this way, the stock will cover most of cutter and act as a guard

B. Be sure that cutter is locked securely to spindle

C. Always position fences so that they will support work that has passed the cutters

D. Adjust spindle for correct height and lock in position; rotate spindle by hand to be sure that it clears all guards and fences

INFORMATION SHEET

E. Check direction of rotation by snapping switch on and off; watch as cutter comes to rest

(NOTE: Some shapers are equipped with a reversing switch so that the spindle can be rotated either clockwise or counterclockwise.)

F. *Always* feed *against* the cutting edge

G. Examine stock carefully for defects before cutting; never cut through a loose knot or through stock that is cracked or split

H. Hold stock down and against fence with hands on top of material, yet out of range of cutters

I. Use all guards, jigs, and clamping devices whenever possible

J. Do not set spring hold-down clips too tightly against work; use just enough tension to hold work against fence

K. Always use a depth collar when shaping irregular work; use a guide pin in table to start the cutting

L. Swing work into cutters when depth collars and guide pin are used for contour work

(NOTE: It is a good idea to keep the stock in motion in the direction of feed.)

M. Never shape a piece shorter than 10 inches

XIV. Uses of a table band saw (Figure 6)

A. Making irregular cuts

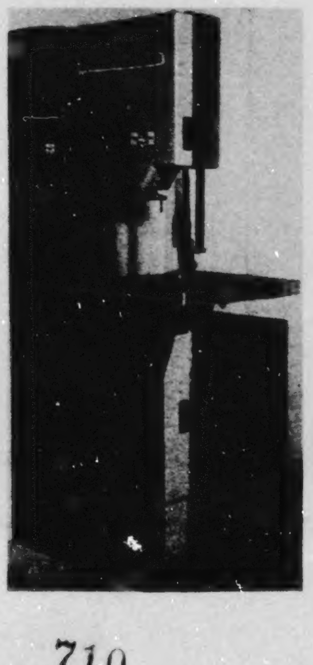
B. Sawing circles

C. Resawing (ripping)

D. Making relief cuts

EXAMPLE:

FIGURE 6



INFORMATION SHEET

XV. Rules for safe use of table band saws

A. Use proper blade size to avoid breakage

B. Do not feed stock too fast

C. Use relief cuts when necessary

D. Adjust saw guide before each cut

XVI. Uses of a bench grinder (Figure 7)

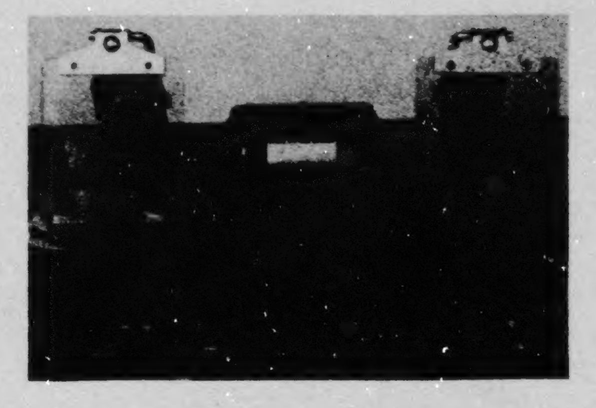
A. Sharpening tools

B. Grinding and shaping steel

C. Grinding burrs and rough pieces from steel

EXAMPLE:

FIGURE 7



XVII. Rules for safe use of bench grinders

A. Always use tool rest

B. Do not use grinder for woods or plastics

C. Never wear gloves when using bench grinder

D. Never use grinder with a cracked or damaged wheel

E. Never force stock into grinding wheel

F. Never use grinder to remove paint

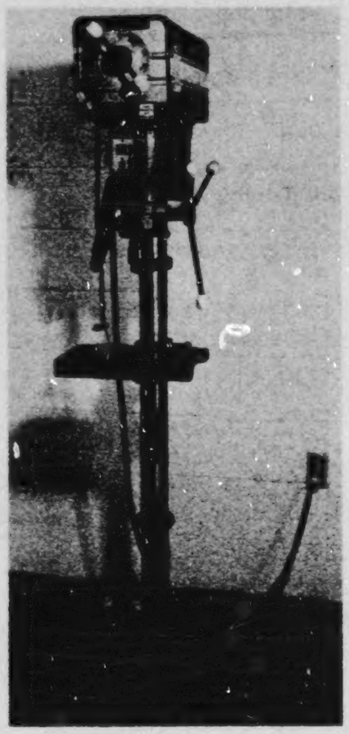
INFORMATION SHEET

XVIII. Uses of a drill press (Figure 8)

- A. Drilling
- B. Boring
- C. Shaping
- D. Tapping
- E. Sanding
- F. Mortising
- G. Grinding
- H. Cutting holes with hole saw

EXAMPLE:

FIGURE 8



XIX. Rules for safe use of drill presses

- A. Always remove chuck key before turning on power
- B. Secure stock before drilling
- C. Use correct speed for job being performed
- D. Do not force drill into stock
- E. Never wear gloves when operating a drill press

INFORMATION SHEET

XX. Uses of a combination belt-and-disc sander (Figure 9)

A. Rough sanding

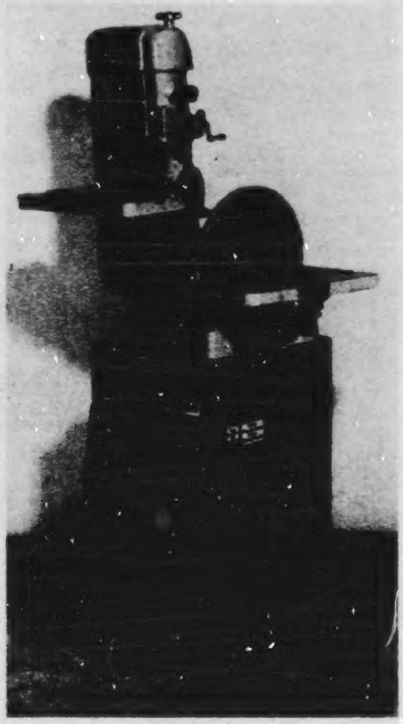
B. Fine sanding

C. Shaping

D. Grinding glass

EXAMPLE:

FIGURE 9



XXI. Rules for safe use of combination belt-and-disc sanders

A. Hold stock firmly with both hands when feeding into sander

B. Do not force stock against abrasive surface

C. Do not use on plastics or other materials that may damage the sanding surfaces

XXII. Uses of a power miter saw (See Figure 10)

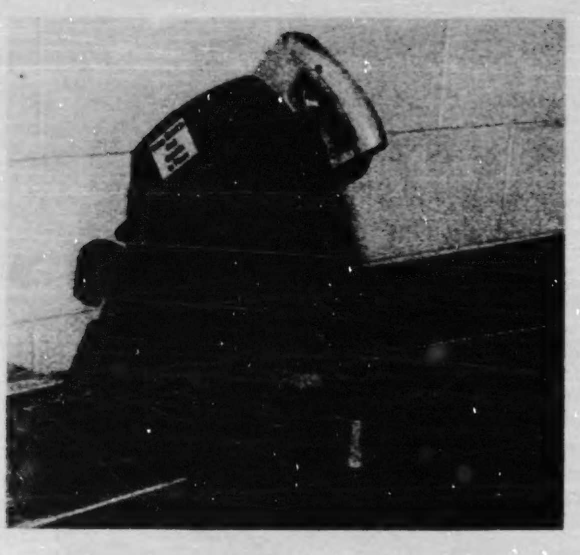
A. Cutting straight miters

B. Crosscutting

INFORMATION SHEET

EXAMPLE:

FIGURE 10



XXIII. Rules for safe use of power miter saws

- A. Do not attempt to cut oversized stock
- B. Enlist a helper to support end of long stock
- C. Turn off motor immediately after making cut

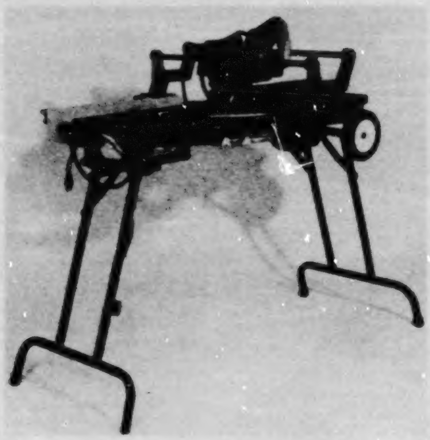
XXIV. Uses of a sawbuck (See Figure 11)

- A. Crosscutting
- B. Making straight miter cuts
- C. Making bevel cuts
- D. Making compound miter cuts

INFORMATION SHEET

EXAMPLE:

FIGURE 11



XXV. Rules for safe use of sawbucks

A. Hold stock firmly against fence

B. Clamp stock to fence when possible

C. Allow motor to gain full speed before starting cut

D. Never reach around or across saw blade

E. Turn off motor immediately after making cut, and press down on brake button

XXVI. Uses of a portable angle grinder and a belt sander

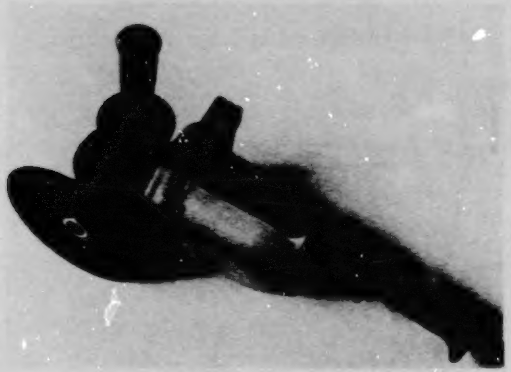
A. Angle grinder (See Figure 12)

1. Rough sanding
2. Grinding metal
3. Grinding concrete
4. Polishing and buffing
5. Removing rust and scale from steel
6. Wire brushing

INFORMATION SHEET

EXAMPLE:

FIGURE 12

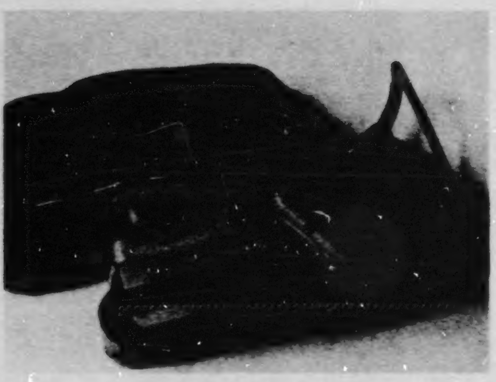


B. Belt sander (Figure 13)

1. Rough sanding
2. Smooth sanding
3. Grinding glass

EXAMPLE:

FIGURE 13



XXVII. Rules for safe use of portable angle grinders and belt sanders

A. Angle grinder

1. Wear gloves when appropriate
2. Use proper grinding head for material being ground

   EXAMPLES: Head for steel, head for concrete

3. Be sure that grinder head has stopped turning before laying grinder down

INFORMATION SHEET

B. Belt sander

1. Keep power cord away from sander belt
2. Hold sander firmly with both hands
3. Be sure that sander has stopped running before laying it down

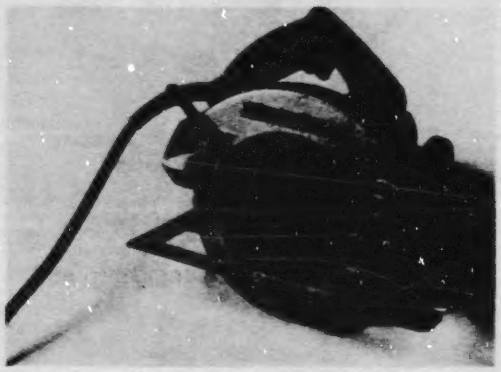
XXVIII. Uses of portable power saws

A. Circular saw (Figure 14)

1. Ripping
2. Crosscutting
3. Making miter cuts
4. Making pocket cuts
5. Making bevel cuts

EXAMPLE:

FIGURE 14

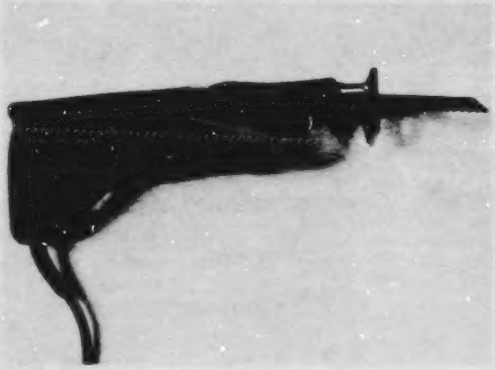


B. Reciprocating saw (Figure 15)

1. Making irregular cuts
2. Crosscutting
3. Making relief cuts
4. Making inside curves and corner cuts
5. Making pocket cuts

EXAMPLE:

FIGURE 15



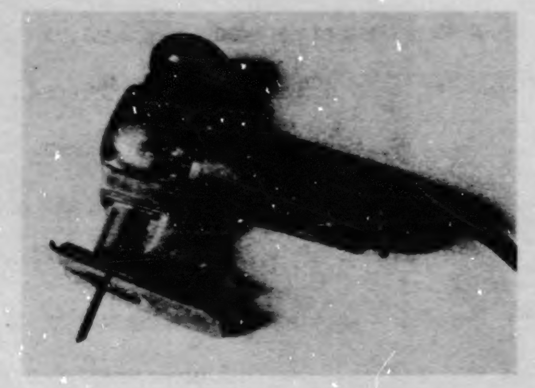
INFORMATION SHEET

C. Jigsaw (saber saw) (Figure 16)

1. Making curves and scroll cuts
2. Making inside curves and corner cuts
3. Making pocket cuts
4. Ripping
5. Crosscutting
6. Making relief cuts

EXAMPLE:

FIGURE 16

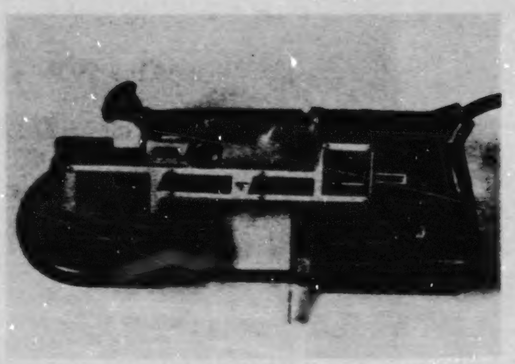


D. Band saw (Figure 17)

1. Cutting metal studs
2. Cutting angle iron and steel rods
3. Cutting pipe

EXAMPLE:

FIGURE 17



XXIX. Rules for safe use of portable power saws

A. Circular saw

1. Keep electric cord clear of blade to avoid cutting cord
2. Be sure that automatic guard is free and retractable

CAUTION

Never lock automatic guard in the retracted position.

INFORMATION SHEET

3. Check stock for nails and any other metal before cutting
4. Use a good, solid support for stock while cutting
5. Allow saw to gain maximum speed before starting cut
6. Set blade only deep enough to cut through stock
7. Lay saw on its side after finishing the cut

B. Reciprocating saw and jigsaw

1. Keep electric cord clear of blade to avoid cutting cord
2. Use the correct blade for the job being done
3. Do not force blade into stock
4. Turn off motor immediately after finishing the cut

C. Band saw

1. Use proper blade size to avoid breakage
2. Use correct blade for job being done
3. Do not force blade into stock

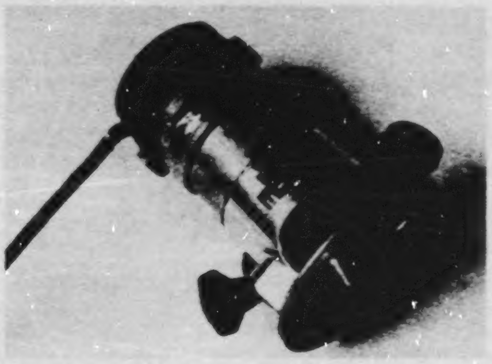
XXX. Uses of a router and a trimmer

A. Router (Figure 18)

1. Shaping edges
2. Rabbeting
3. Beveling
4. Dovetailing
5. Dadoing, fluting, and reeding
6. Mortising

EXAMPLE:

FIGURE 18



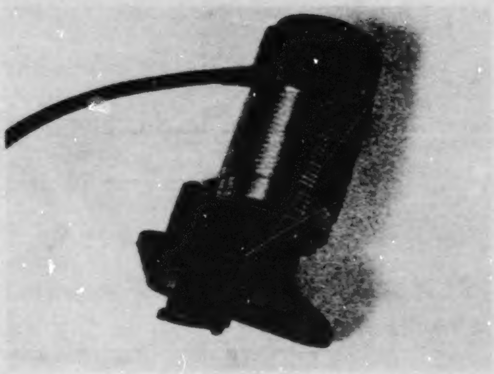
INFORMATION SHEET

B. Trimmer (Figure 19)

1. Cutting laminate
2. Bevel trimming
3. Flush trimming
4. Cutting obtuse and acute angles

EXAMPLE:

FIGURE 19



XXXI. Rules for safe use of routers and trimmers

A. Avoid making cuts too deep for tool being used

(NOTE: Too deep a cut can cause kickbacks.)

B. Be sure that stock is secured properly before routing

C. Always use a door jack when routing for door hinges

D. Always use jigs and guides with router; never rout or plow freehand

E. When using a router or trimmer, approach workpiece gently; never gouge bit into stock

XXXII. Uses of a portable drill, screwdriver, and hammer drill

A. Drill (See Figures 20 and 21)

1. Boring and drilling
2. Cutting holes with hole saw
3. Mixing materials

INFORMATION SHEET

4. Driving screws

EXAMPLES:

FIGURE 20: ¼-inch drill

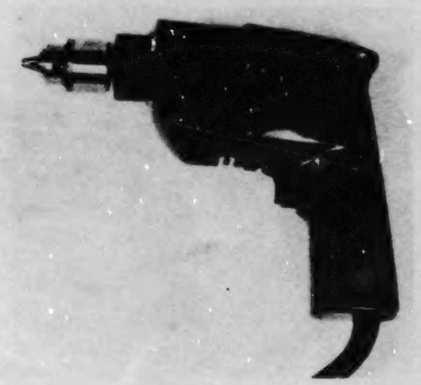
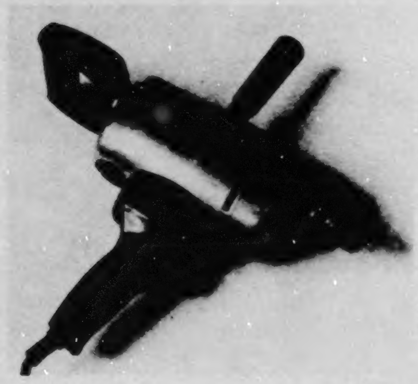


FIGURE 21: ½-inch drill

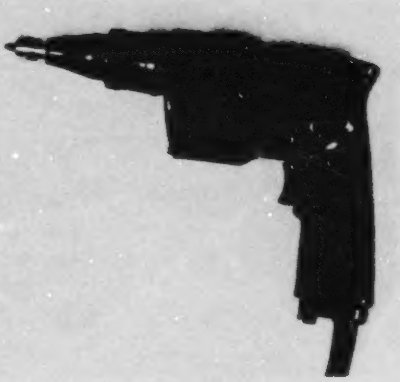


B. Screwdriver (Figure 22)

1. Driving and removing wood screws
2. Driving and removing machine screws
3. Driving and removing thread-cutting screws
4. Driving and removing lag bolts

EXAMPLE:

FIGURE 22



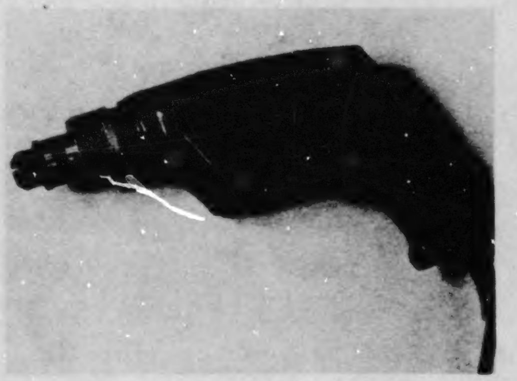
INFORMATION SHEET

C. Hammer drill (Figure 23)

1. Drilling holes in masonry and concrete
2. Drilling holes in wood and other materials
3. Setting anchors
4. Performing light chipping work
5. Mixing materials

EXAMPLE:

FIGURE 23



XXXIII. Rules for safe use of portable drills, screwdrivers, and hammer drills

A. Portable drill and hammer drill

1. Always remove chuck key before starting drill

   (NOTE: The chuck key is the device used to lock the drill or tool into the chuck.)

2. Never attempt to use auger bits designed for a hand brace
3. Never attempt to stop drill by taking hold of chuck
4. Do not force drill into stock
5. On deep cuts, back drill out often to clean out hole
6. Never point drill at anyone

B. Screwdriver

1. Use correct type and size bit for screws being used
2. Never place screw point against any part of your body
3. Never hold your hand behind material into which you are driving the screw

INFORMATION SHEET

XXXIV. Uses of a portable power plane (Figure 24)

A. Straightening material

B. Face planing

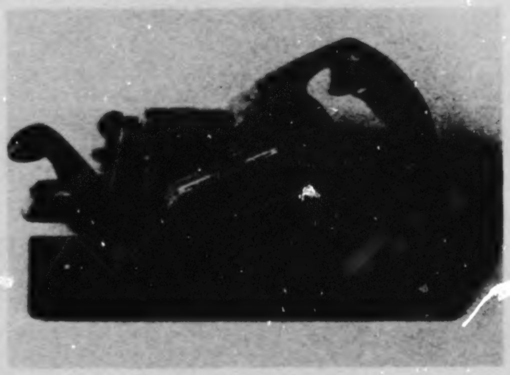
C. Edge planing

D. Chamfering

E. Beveling

EXAMPLE:

FIGURE 24



XXXV. Rules for safe use of portable power planes

A. Be sure that stock is secure before planing

B. Keep hand or hands in proper location on plane

C. Always use a door jack when planing door edges

XXXVI. Uses of a rotary hammer and a chipping hammer

A. Rotary hammer (Figure 25)

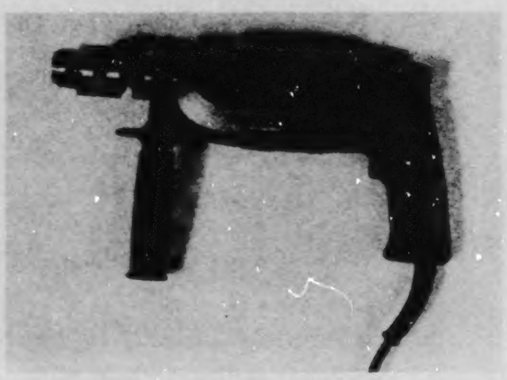
1. Drilling holes in masonry and concrete

2. Setting anchors

3. Performing light chipping work

EXAMPLE:

FIGURE 25



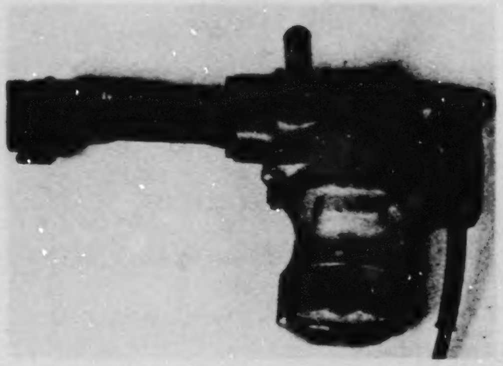
INFORMATION SHEET

B. Chipping hammer (Figure 26)

1. Chipping masonry and concrete
2. Bushhammering concrete

EXAMPLE:

FIGURE 26



XXXVII. Rules for safe use of rotary and chipping hammers

A. Never point hammer at anyone while it is running

B. Keep feet and hands clear of tool

C. Do not use point or chisel for prying

XXXVIII. Uses of metal shears (Figure 27)

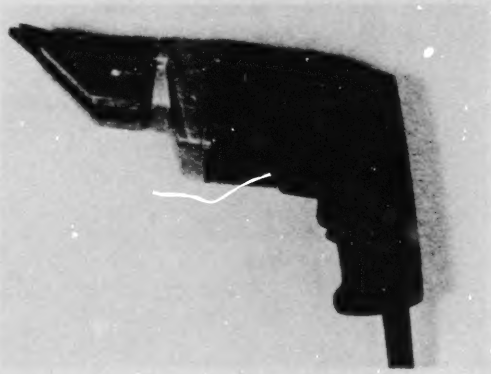
A. Cutting sheet metal

B. Cutting metal straps

C. Cutting special lightweight materials

EXAMPLE:

FIGURE 27



INFORMATION SHEET

XXXIX. Rules for safe use of metal shears

- A. Never force tool into stock
- B. Do not attempt to cut stock that is too thick
- C. Keep fingers away from sharp edges of stock being cut

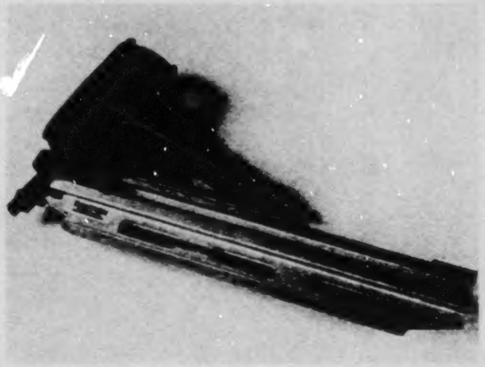
XL. Uses of pneumatic fasteners

(NOTE: A pneumatic fastener is an air-powered tool that drives nails or staples.)

- A. Nailer (Figure 28)
  1. Applying sheathing
  2. Applying decking
  3. Installing framing
  4. Installing finish work

EXAMPLE:

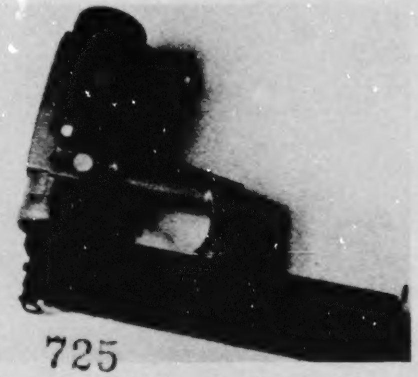
FIGURE 28



- B. Stapler (Figure 29)
  1. Applying sheathing
  2. Applying decking
  3. Applying roofing
  4. Installing insulation
  5. Installing ceiling tile
  6. Installing paneling

EXAMPLE:

FIGURE 29



INFORMATION SHEET

XLI. Rules for safe use of pneumatic fasteners

A. Use pressure specified by manufacturer

B. Use only nails or staples designed for fastener being used

C. Use caution when attaching fastener to air supply because fastener may discharge

D. Keep hands and body away from discharge end of fastener

E. Do not discharge fasteners except when actually nailing or stapling

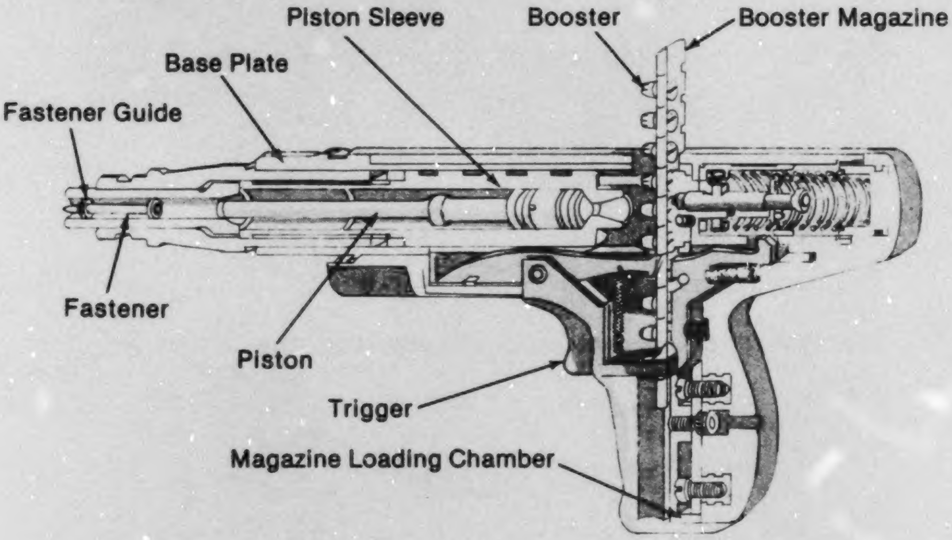
F. Never point fasteners at anyone

G. Never use fasteners on soft or thin material that nails may go through

XLII. The parts of a powder-actuated tool (Figure 30)

(NOTE: A powder-actuated tool is a semiautomatic, low-velocity fastening system operated by powder-actuated cartridges.)

FIGURE 30


Piston Sleeve
Booster
Booster Magazine
Base Plate
Fastener Guide
Fastener
Piston
Trigger
Magazine Loading Chamber

Adapted with permission of Hilti Fastening Systems, Tulsa, Oklahoma.

INFORMATION SHEET

XLIII. Uses of a powder-actuated tool (Figure 31)

A. Driving pins and threaded studs

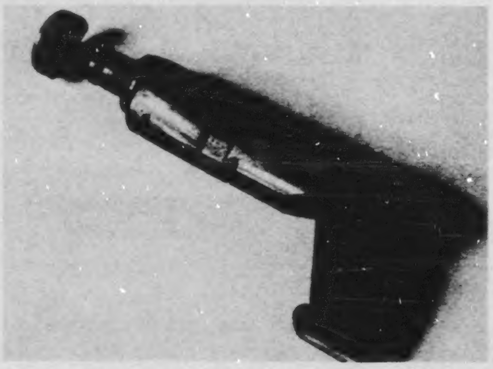
B. Fastening wood to concrete, masonry, and steel

C. Fastening steel to steel

D. Fastening steel to concrete

EXAMPLE:

FIGURE 31



XLIV. Rules for safe use of powder-actuated tools

> **CAUTION**
>
> Before using a powder-actuated tool, the operator must be certified and must possess a safety certification card.

A. Do not use powder-actuated tool until you are certified

(NOTE: See your instructor about certification.)

B. Follow *all* safety precautions in manufacturer's instruction manual

C. Always wear safety goggles and hard hat when operating tool

D. Use proper pin size for job you are performing

E. Use correct booster according to selector chart in toolbox

F. Never hold end of barrel against any part of your body, or cock tool against your hand

G. Never hold hand behind material you are fastening

H. Do not shoot close to edge of concrete

I. Never attempt to pry booster out of magazine with sharp instrument

J. Always wear ear protection in confined area

INFORMATION SHEET

XLV. Uses of circular-saw blades

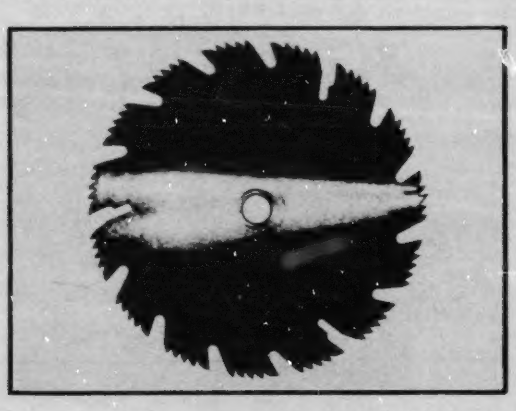
A. Master combination blade (48 to 60 teeth) (Figure 32)

(NOTE: The master combination blade is an all-purpose blade used for smooth, fast cutting.)

1. Crosscutting
2. Ripping
3. Mitering
4. General-purpose use

EXAMPLE:

FIGURE 32



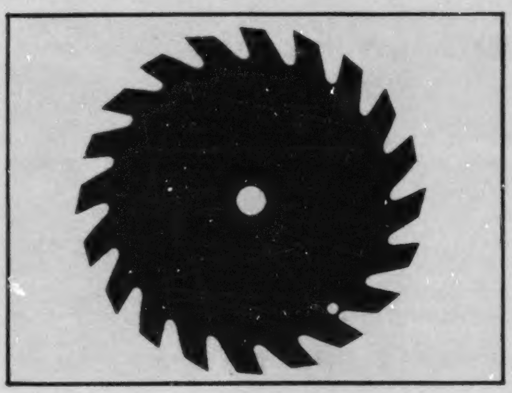
B. Chisel-tooth combination blade (24 to 30 teeth) (Figure 33)

(NOTE: The chisel-tooth combination blade is a free-cutting, general-purpose blade for cutting in any direction.)

1. Crosscutting
2. Ripping
3. Mitering
4. General-purpose use

EXAMPLE:

FIGURE 33



INFORMATION SHEET

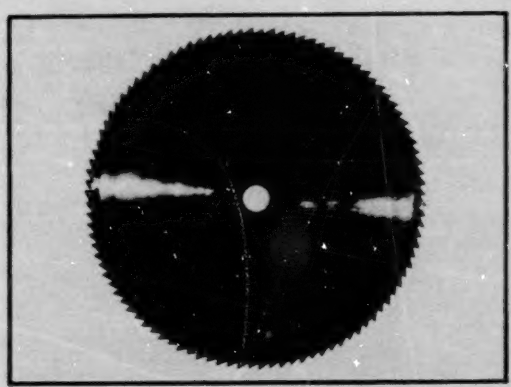
C. Combination rip blade (36 to 44 teeth) (Figure 34)

(NOTE: The combination rip blade is a very popular all-purpose blade.)

1. Crosscutting
2. Ripping
3. Mitering
4. General-purpose use

EXAMPLE:

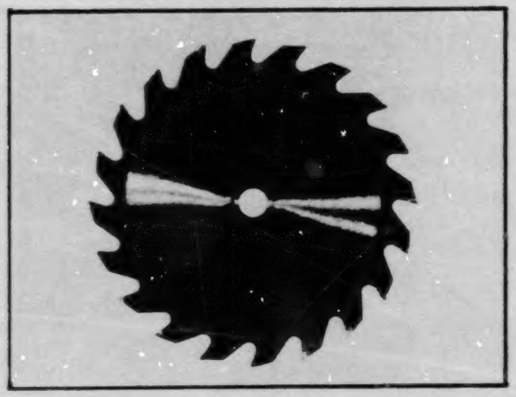
FIGURE 34



(NOTE: Most of the combination blades can be purchased with carbide-tipped teeth. These blades are very popular because of their economy and quality. See Figure 35.)

EXAMPLE: Carbide-tipped blade

FIGURE 35



INFORMATION SHEET

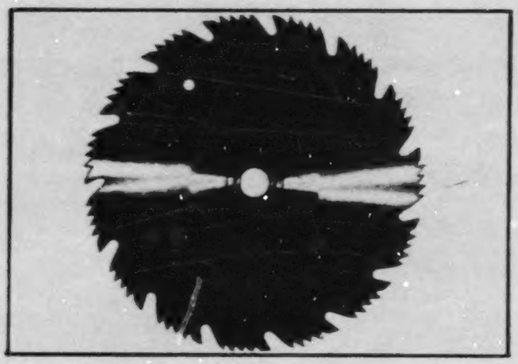
D. Hollow-ground plane (miter) blade (48 to 60 teeth) (Figure 36)

(NOTE: The hollow-ground plane blade makes smooth finish cuts on all solid woods and is ideal for cabinet work.)

1. Crosscutting
2. Ripping
3. Mitering
4. Finish cabinet work

EXAMPLE:

FIGURE 36



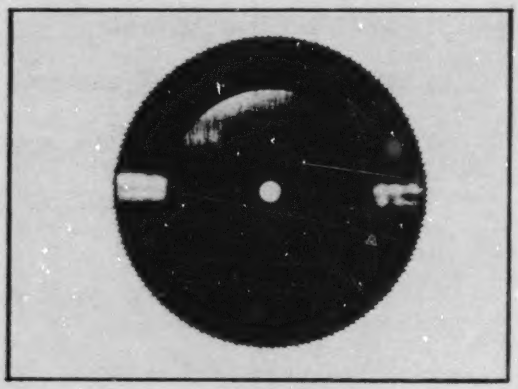
E. Crosscut-flooring blade (10 to 100 teeth) (Figure 37)

(NOTE: The crosscut-flooring blade is a general-purpose, cut-off blade that is good for use on hardwoods and softwoods.)

1. Crosscutting
2. Mitering

EXAMPLE:

FIGURE 37



POWER TOOLS
UNIT II

ASSIGNMENT SHEET #1 — COMPLETE A SAFETY TEST FOR SPECIFIC TOOLS

NAME ________________________________ SCORE ____________

To operate a power tool correctly, you must know not only the operating instructions but also the specific safety rules for that tool. Before you will be allowed to operate any power tool, you must be able to show that you can operate the tool safely.

Complete the safety rules for each of the following pieces of equipment. Write your answers in the blanks.

A. Table saw

1. Make sure that blade does not project more than __________ above stock being cut
2. Use a __________ __________ for ripping all stock less than 4 inches wide
3. Do not rip without __________ __________, or crosscut without __________ __________
4. When blade is tilted, be sure that blade will __________ stock before turning on machine

B. Radial arm saw

1. Make sure that saw is set at __________ __________ before turning it on
2. Do not stand directly in line with ________________________
3. Always use ____________ ____________ when ripping
4. Do not __________ __________ by forcing scrap wood into blade

C. Jointer

1. ____________ ____________ of cut before power is turned on
2. Do not use stock less than __________ inches long
3. Do not use strips less than __________ inch wide
4. Avoid taking cuts deeper than __________; too deep a cut can cause kickbacks

ASSIGNMENT SHEET #1

D. Power plane

1. Do not attempt to ____________ too much material with one cut
2. Make ______________________________ only after power has been disconnected
3. Check stock to be sure that it is free of ___________________ or other ________________ that may damage machine or be dangerous to operator

E. Shaper

1. Be sure that ________________ is locked securely to spindle
2. Always position ____________ so that they will support work that has passed the cutters
3. Check ________________ _____ ________________ by snapping switch on and off; watch as cutter comes to rest
4. *Always* feed ________________ the cutting edge
5. Use all ____________, ____________, and ____________ devices whenever possible
6. Never shape a piece shorter than ____________ inches

F. Table band saw

1. Use ________________ blade size to avoid breakage
2. Use ________________ cuts when necessary

G. Bench grinder

1. Always use tool ________________
2. Do not use grinder for ________________ or ________________
3. Never wear ________________ when using bench grinder

ASSIGNMENT SHEET #1

H. Drill press

1. ________________ stock before drilling

2. Use ____________ ____________ for job being performed

3. Never wear ________________ when operating a drill press

I. Combination belt-and-disc sander

1. Hold stock ____________ with ____________ ____________ when feeding into sander

2. Do not use on ____________ or other ____________ that may damage the sanding surfaces

J. Power miter saw

1. Do not attempt to cut ________________ stock

2. Enlist a ________________ to support end of long stock

3. Turn off motor ________________ after making cut

K. Sawbuck

1. Hold stock ____________ against fence

2. ________________ stock to fence when possible

3. Never reach ________________ or ________________ saw blade

4. Turn off motor ________________ after making cut, and press down on ________________ ________________

L. Portable angle grinder

1. Wear gloves when ______________________________

2. Be sure that grinder head has stopped ____________________ before ________________ grinder down

ASSIGNMENT SHEET #1

M. Portable belt sander

1. Keep power _________________ away from sander _________________
2. Hold sander firmly with _____________ _____________

N. Portable circular saw

1. Be sure that automatic guard is _________________ and _________________
2. _____________ blade only _________________ enough to cut through stock
3. Lay saw on its _________________ after finishing the cut

O. Portable reciprocating saw and jigsaw

1. _____________ _____________ motor immediately after finishing the cut
2. Do not _________________ blade into stock

P. Portable band saw

1. Use _____________ blade size to avoid _________________
2. Use _________________ blade for job being done

Q. Router and trimmer

1. Be sure that stock is _________________ properly before routing
2. Always use a _____________ _____________ when routing for door _____________
3. Always use _____________ and _____________ with router; never rout or plow

____

R. Portable drill and hammer drill

1. Always remove _____________ _____________ before starting drill
2. Never attempt to _________________ drill by taking hold of _____________
3. Never _________________ drill at anyone

S. Portable screwdriver

1. Use correct _____________ and _____________ bit for screws being used

ASSIGNMENT SHEET #1

2. Never place ____________ ____________ against any part of your ____________

3. Never hold your ____________ behind the ________________ into which you are ________________ the screw

T. Portable power plane

1. Be sure that stock is ________________ before planing

2. Keep ____________ or ____________ in proper ____________ on plane

3. Always use a ____________ ____________ when planing door ________________

U. Rotary and chipping hammer

1. Never ________________ hammer at anyone while it is ____________

2. Do not use point or chisel for ______________________________

V. Metal shears

1. Never ________________ tool into stock

2. Do not attempt to ____________ stock that is too ____________

W. Pneumatic fastener

1. Use ________________ specified by manufacturer

2. Use only nails or staples ________________ for fastener being used

3. Use caution when attaching fastener to ____________ ____________ because fastener may ________________

4. Keep hands and body away from ________________ end of fastener

5. Do not ________________ fasteners except when actually ________________ or ________________

6. Never use fasteners on ____________ or ____________ material that nails may go through

ASSIGNMENT SHEET #1

X. Powder-actuated tool

1. Do not use powder-actuated tool until you are ____________________
2. Use ____________________ pin size for job you are performing
3. Use correct booster according to ____________ ____________ in toolbox
4. Never hold end of barrel against any ____________ of your ____________, or cock tool against your ____________
5. Never hold ____________ behind ____________ you are fastening
6. Never attempt to ____________ booster out of magazine with ____________ instrument

POWER TOOLS
UNIT II

ANSWERS TO ASSIGNMENT SHEET

Assignment Sheet #1

A. Table saw

1. 1/8 inch
2. Push stick
3. Rip fence, miter gauge
4. Clear

B. Radial arm saw

1. Proper depth
2. Blade
3. Antikickback guard
4. Stop blade

C. Jointer

1. Adjust depth
2. 12
3. 1
4. 1/8 inch

D. Power plane

1. Remove
2. Adjustments
3. Nails, objects

E. Shaper

1. Cutter
2. Fences
3. Direction of rotation
4. Against
5. Guards, jigs, clamping
6. 10

F. Table band saw

1. Proper
2. Relief

G. Bench grinder

1. Rest
2. Woods, plastics
3. Gloves

H. Drill press

1. Secure
2. Correct speed
3. Gloves

I. Combination belt-and-disc sander

1. Firmly, both hands
2. Plastics, materials

J. Power miter saw

1. Oversized
2. Helper
3. Immediately

K. Sawbuck

1. Firmly
2. Clamp
3. Around, across
4. Immediately, brake button

L. Portable angle grinder

1. Appropriate
2. Turning, laying

M. Portable belt sander

1. Cord, belt
2. Both hands

ANSWERS TO ASSIGNMENT SHEET

N. Portable circular saw

1. Free, retractable
2. Set, deep
3. Side

O. Portable reciprocating saw

1. Turn off
2. Force

P. Portable band saw

1. Proper, breakage
2. Correct

Q. Router and trimmer

1. Secured
2. Door jack, hinges
3. Jigs, guides, freehand

R. Portable drill and hammer drill

1. Chuck key
2. Stop, chuck
3. Point

S. Portable screwdriver

1. Type, size
2. Screw point, body
3. Hand, material, driving

T. Portable power plane

1. Secure
2. Hand, hands, location
3. Door jack, edges

U. Rotary and chipping hammer

1. Point, running
2. Prying

V. Metal shears

1. Force
2. Cut, thick

W. Pneumatic fastener

1. Pressure
2. Designed
3. Air supply, discharge
4. Discharge
5. Discharge, nailing, stapling
6. Soft, thin

X. Powder-actuated tool

1. Certified
2. Proper
3. Selector chart
4. Part, body, hand
5. Hand, material
6. Pry, sharp

POWER TOOLS
UNIT II

JOB SHEET #1 — PERFORM STRAIGHT AND ANGLE CUT-OFF OPERATIONS

I. Tools and equipment

  A. Safety goggles

  B. Table saw, radial arm saw, portable circular saw, portable jigsaw, table band saw

  C. Miter gauge

  D. Circular saw protractor

  E. Folding rule or tape

  F. Pencil

  G. Try square or bevel

  H. Sawhorse or other solid support

  I. Five 2×4s about 18 inches long

II. Procedure for table saw

  A. Straight cut

    1. Check to see that power is off

    2. Check to see that all safety devices are in place

    3. Adjust blade so that it is slightly higher than thickness of material being cut

    4. Measure and mark 2×4 at proper length (given by instructor)

    5. Place 2×4 in front of miter gauge, and align mark with blade for proper cut

    6. Put on safety goggles

    7. Turn on power

    8. Check with instructor for approval before starting saw

    9. Check to see that everyone is clear of saw

JOB SHEET #1

10. Start saw

> **CAUTION**
>
> Keep hands away from path of saw blade, and stand slightly to one side of blade path. Never stand directly in line with saw blade.

11. Hold 2×4 tightly against miter gauge, and slowly move gauge toward saw blade, using a smooth, uniform rate of speed
12. Continue moving miter gauge and stock forward until cut is complete
13. Turn off saw immediately after cut is made
14. After blade has stopped turning, remove stock and return miter gauge to starting position
15. Discard scrap in proper receptacle
16. Turn off power

    (NOTE: If angle cut is to be made immediately, it will not be necessary to turn off power, readjust blade, or recheck safety devices.)

17. Remove safety goggles

B. Angle cut

1. Adjust miter gauge to proper angle (given by instructor)
2. Measure and mark angle on 2×4 at proper length (given by instructor)
3. Place 2×4 in front of miter gauge, and align mark with blade for proper cut
4. Put on safety goggles
5. Turn on power
6. Check with instructor for approval before starting saw
7. Check to see that everyone is clear of saw
8. Start saw

> **CAUTION**
>
> Keep hands away from path of saw blade, and stand slightly to one side of blade path. Never stand directly in line with saw blade.

JOB SHEET #1

9. Hold 2×4 tightly against miter gauge, and slowly move gauge and 2×4 toward blade, using a smooth, uniform rate of speed
10. Continue moving gauge and stock forward until cut is complete
11. Turn off saw immediately after cut is made
12. After blade has stopped turning, remove stock and return miter gauge to starting position
13. Discard scrap in proper receptacle
14. Lower blade below top of table
15. Turn off power
16. Remove safety goggles
17. Clean up area and put away tools

III. Procedure for radial arm saw

A. Straight cut

1. Check to see that power is off
2. Check to see that all safety devices are in place
3. Adjust track so that it is at a right angle to fence; lock in position
4. Adjust blade so that it is slightly lower than thickness of material being cut
5. Measure and mark 2×4 at proper length (given by instructor)
6. Place saw in starting position at rear of table
7. Place 2×4 against fence on saw table, and align mark with saw blade
8. Put on safety goggles
9. Turn on power
10. Check with instructor for approval before starting saw
11. Check to see that everyone is clear of saw

JOB SHEET #1

12. Start saw and let it gain maximum speed

CAUTION

Keep hands away from path of saw blade, and stand slightly to one side of blade path. Never stand directly in line with saw blade.

13. Hold 2×4 tightly against fence, and slowly move saw forward, using a smooth, uniform rate of speed
14. Continue moving saw forward until cut is complete
15. Turn off saw immediately after cut is made
16. After blade has stopped turning, remove stock
17. Return saw to starting position
18. Discard scrap in proper receptacle
19. Turn off power

    (NOTE: If angle cut is to be made immediately, it will not be necessary to turn off power or recheck safety devices.)

20. Remove safety goggles

B. Angle cut

1. Adjust saw to proper angle (given by instructor)
2. Measure and mark angle on 2×4 at proper length (given by instructor)
3. Place 2×4 against fence on saw table, and align mark with saw blade
4. Put on safety goggles
5. Check with instructor for approval before starting saw
6. Check to see that everyone is clear of saw
7. Start saw and let it gain maximum speed

CAUTION

Keep hands away from path of saw blade, and stand slightly to one side of blade path. Never stand directly in line with saw blade.

JOB SHEET #1

8. Hold 2×4 tightly against fence, and slowly move saw forward, using a smooth, uniform rate of speed
9. Continue moving saw forward until cut is complete
10. Turn off saw immediately after cut is made
11. After blade has stopped turning, remove stock
12. Return saw to starting position
13. Discard scrap in proper receptacle
14. Turn off power
15. Remove safety goggles
16. Clean up area and put away tools

IV. Procedure for portable circular saw

   A. Straight cut

1. Check to see that automatic blade guard is free and retractable
2. Adjust blade so that it is slightly lower than thickness of material being cut
3. Check blade to see that it is sharp and not damaged
4. Plug saw into power source, making sure that saw is grounded
5. Measure and mark 2×4 at proper length (given by instructor)
6. Put on safety goggles
7. Hold 2×4 securely on solid support, and align saw blade with mark on 2×4
8. Check with instructor for approval before starting saw
9. Check to be sure that blade is clear of stock before starting saw
10. Start saw and let it gain maximum speed
11. Hold 2×4 securely; advance saw into work slowly but firmly
12. Turn off saw immediately after cut is made

13. Check to be sure that blade guard has returned to its proper position

14. After blade has stopped turning, lay saw on its side

15. Discard scrap in proper receptacle

16. Unplug saw from power source

    (NOTE: If angle cut is to be made immediately, it will not be necessary to unplug saw from power source or to repeat steps 1 through 4 under straight-cut procedures.)

17. Remove safety goggles

B. Angle cut

1. Measure and mark angle on 2×4 at proper length (angle and depth given by instructor)

2. Put on safety goggles

3. Hold 2×4 securely on solid support, and align saw blade with the mark on the 2×4

    (NOTE: An adjustable protractor may be used to assist in making a more accurate cut.)

4. Check with instructor for approval before starting saw

5. Check to be sure that blade is clear of stock before starting saw

6. Start saw and let it gain maximum speed

7. Hold 2×4 securely; advance saw into work slowly but firmly

8. Turn off saw immediately after making cut

9. After blade has stopped turning, lay saw on its side

10. Discard scrap in proper receptacle

11. Unplug saw from power source

12. Remove safety goggles

13. Clean up area and put away tools

JOB SHEET #1

V. Procedure for portable jigsaw

A. Straight cut

1. Check blade to see that it is the right blade for the job and that it is sharp and undamaged
2. Plug saw into power source, making sure that saw is grounded
3. Measure and mark 2×4 at proper length (given by instructor)
4. Put on safety goggles
5. Hold 2×4 securely on solid support, and align saw blade with mark on 2×4
6. Hold base of saw firmly on work, and check to be sure that blade clears work
7. Check with instructor for approval before starting saw
8. Start saw
9. Advance saw forward into work, and carefully guide saw blade into layout line
10. Continue feeding saw into work as fast as possible without forcing it
11. Complete the cut
12. Turn off saw immediately after cut is made
13. After blade has stopped moving, lay saw on its side
14. Discard scrap in proper receptacle
15. Unplug saw from power source

    (NOTE: If angle cut is to be made immediately, it will not be necessary to unplug saw from power source or to repeat steps 1 and 2 under straight-cut procedure.)

16. Remove safety goggles

B. Angle cut

1. Use same procedure as for making a straight cut

    (NOTE: Radius or curved cuts also follow the same procedure, especially the step for carefully guiding the saw blade to follow the layout lines.)

2. Clean up area and put away tools

JOB SHEET #1

VI. Procedure for table band saw

A. Straight cut

1. Check to see that power is off
2. Check to see that all safety devices are in place
3. Check blade size, tension, and condition (check with instructor for proper size and tension)
4. Check to see whether blade is centered by rotating upper wheel by hand; if adjustment is necessary, check with instructor
5. Check adjustment of guide assemblies

   (NOTE: If guide assemblies or blade needs adjustment, check with your instructor. Do not try to adjust without the instructor's supervision.)

6. Adjust height of upper guide assembly so that it clears top surface of 2×4
7. Measure and mark 2×4 at proper length (given by instructor)
8. Put on safety goggles
9. Check with instructor for approval before starting saw
10. Check to see that everyone is clear of saw
11. Turn on power and start saw
12. Hold 2×4 firmly on table, and align saw blade with mark on 2×4

    CAUTION

    Keep hands away from path of blade.

13. Feed 2×4 into blade, following layout line on stock
14. Continue feeding 2×4 into blade as fast as possible without forcing it

    (NOTE: For a smooth cut, stock should be fed into blade with a continuous forward motion.)

15. Complete cut
16. Turn off saw immediately after cut is made

JOB SHEET #1

17. After blade has stopped, remove stock

18. Discard scrap in proper receptacle

19. Turn off power

    (NOTE: If angle cut is to be made immediately, it will not be necessary to unplug saw from power source or to repeat steps 1 through 4 under straight-cut procedure.)

20. Remove safety goggles

B. Angle cut

1. Use same procedure as for making a straight cut

   (NOTE: To make a more accurate cut, you may want to use the miter gauge.)

2. Clean up area and put away tools

POWER TOOLS
UNIT II

JOB SHEET #2 — PERFORM RIPPING OPERATIONS

I. Tools and equipment

- A. Safety goggles
- B. Table saw, radial arm saw, table band saw, portable circular saw, portable jigsaw
- C. Ripping fence for table saw, table band saw, portable circular saw, and portable jigsaw
- D. Push stick
- E. Folding rule or tape
- F. Pencil
- G. Sawhorse or other solid support
- H. Five 6" x 12" pieces of ¾-inch plywood

II. Procedure for table saw

- A. Check to see that power is off
- B. Check to see that all safety devices are in place
- C. Adjust blade so that it is slightly higher than thickness of material being cut
- D. Measure desired width (furnished by instructor) from fence to nearest saw tooth; lock fence in place
- E. Put on safety goggles
- F. Turn on power
- G. Place push stick in a convenient location if it is needed
- H. Check with instructor for approval before starting saw
- I. Check to see that everyone is clear of saw
- J. Start saw

CAUTION

Keep hands away from path of saw blade, and stand slightly to one side of blade path. Never stand directly in line with saw blade.

JOB SHEET #2

K. Hold stock firmly against fence, and feed it in a smooth, continuous motion

L. As end of stock approaches blade, push stock through blade with hand or push stick

> **CAUTION**
>
> If finish piece (piece against fence) is under 4 inches wide, use a push stick—*not* your hand—to push it through the blade.

M. Turn off saw immediately after cut is made

N. After blade has stopped turning, remove stock

O. Discard scrap in proper receptacle

P. Turn off power

Q. Remove safety goggles

R. Clean up area and put away tools

III. Procedure for radial arm saw

A. Check to see that power is off

B. Check to see that all safety devices are in place

C. Adjust saw so that blade is parallel to fence; lock saw in place

D. Locate saw for desired width of cut (established by instructor)

E. Adjust blade so that it is slightly lower than thickness of material being cut

F. Lower kickback assembly until fingers are approximately 1/8 inch lower than material

G. Put on safety goggles

H. Turn on power

I. Check with instructor for approval before starting saw

J. Check to see that everyone is clear of saw

K. Start saw and let it gain maximum speed

> **CAUTION**
>
> Keep hands away from path of saw blade.

JOB SHEET #2

L. Hold stock firmly against fence, and feed it forward in a smooth, continuous motion

(NOTE: Use a push stick when ripping narrow stock.)

M. Turn off saw immediately after cut is made

N. After blade has stopped turning, remove stock

O. Discard scrap in proper receptacle

P. Turn off power

Q. Remove safety goggles

R. Clean up area and put away tools

IV. Procedure for table band saw

A. Check to see that power is off

B. Check to see that all safety devices are in place

C. Check blade size, tension, and condition (check with instructor for proper size and tension)

D. Check to see whether blade is centered

E. Check adjustment of guide assemblies

(NOTE: If guide assemblies or blade needs adjustment, check with your instructor. Do not try to adjust without the instructor's supervision.)

F. Adjust upper guide assembly so that it clears top surface of stock being cut

G. Measure the desired width (furnished by instructor) from fence to blade; lock fence in place

H. Put on safety goggles

I. Turn on power

J. Check with instructor for approval before starting saw

K. Check to see that everyone is clear of saw

L. Start saw

JOB SHEET #2

M. Hold stock firmly against fence, and feed stock into blade

> **CAUTION**
> Keep hands away from path of blade.

N. Continue feeding stock into blade as fast and as smoothly as possible without forcing it

O. Turn off saw immediately after cut is made

P. After blade has stopped, remove stock

Q. Discard scrap in proper receptacle

R. Turn off power

S. Remove safety goggles

T. Clean up area and put away tools

V. Procedure for portable circular saw

A. Check to see that automatic blade guide is free and retractable

B. Install rip blade on saw and adjust to proper depth

C. Install rip fence on saw and adjust to width of cut (established by instructor)

D. Plug saw into power source, making sure that saw is grounded

E. Secure stock on solid support

F. Put on safety goggles

G. Check to be sure that blade is clear of stock before starting saw

H. Check with instructor for approval before starting saw

I. Start saw and let it gain maximum speed

J. Advance saw slowly but firmly into stock, keeping stock against fence

K. Turn off saw immediately after cut is made

L. Check to be sure that blade guard has returned to its proper position

M. After blade has stopped turning, lay saw on its side

JOB SHEET #2

N. Remove stock, and discard scrap in proper receptacle

O. Unplug saw from power source

P. Remove safety goggles

Q. Clean up area and put away tools

VI. Procedure for portable jigsaw

A. Check blade to see that it is the correct type for ripping and that it is sharp and undamaged

B. Install rip fence on saw and adjust to width of cut (established by instructor)

C. Plug saw into power source, making sure that saw is grounded

D. Secure stock on solid support

E. Put on safety goggles

F. Check to be sure that saw blade is clear of stock

G. Check with instructor for approval before starting saw

H. Start saw

I. Advance saw into stock as fast as possible without forcing it; keep stock against fence

J. Turn off saw immediately after cut is made

K. After blade has stopped moving, lay saw on its side

L. Remove stock, and discard scrap in proper receptacle

M. Unplug saw from power source

N. Remove safety goggles

O. Clean area and put away tools

POWER TOOLS
UNIT II

JOB SHEET #3 — MAKE MITER AND COMPOUND MITER CUTS

I. Tools and equipment

   A. Safety goggles

   B. Miter saw and sawbuck

   C. Folding rule or tape

   D. Three pieces of crown molding 4 feet long

   E. Try square or bevel

II. Procedure for miter saw

   A. Miter cut

      1. Check to see that saw is set up on a solid, level surface

      2. Inspect blade to be sure that it is sharp and undamaged

      3. Check to see that all safety devices are in place

      4. Adjust saw to make a right-hand, 45-degree cut; lock in place

      5. Plug saw into power source, making sure that saw is grounded

      6. Put on safety goggles

      7. Check to be sure blade is clear of stock and that saw is in its retracted position

      8. Check with instructor for approval before starting saw

      9. Start saw and let it gain maximum speed

      10. Place molding on saw table against fence

      11. While holding molding against fence, move saw down to cut a right-hand miter at the extreme left end of molding

      12. Turn off saw immediately after cut is made, and return saw to its starting position

      13. Measure and mark molding at proper length (established by instructor)

JOB SHEET #3

14. Unlock and readjust saw to make a left-hand, 45-degree cut; lock in place

15. Place molding against fence on saw table, aligning mark with blade

16. Start saw and let it gain maximum speed

17. Holding molding tightly against fence, cut a left-hand miter at established mark

18. Turn off saw

19. Use try square or bevel to check for proper angle

20. Following the same procedure, cut another piece of molding exactly the same size as the first and with the same miters

21. Lay the two pieces on a flat work table and fit the two angles together

22. Use try square to check angle formed by the two pieces

    (NOTE: If the angle is 90 degrees, the cut is good; if not, you will have to readjust saw and try again.)

23. Discard scrap in proper receptacle

24. Unplug saw from power source

25. Remove safety goggles

26. Clean up area and put away tools

B. Compound miter cuts

(NOTE: Compound miter cuts cannot be made on the power miter saw because the blade cannot be tilted.)

III. Procedure for sawbuck

A. Miter cut

1. Check to see that saw is set up on a solid, level surface

2. Inspect blade to be sure that it is sharp and undamaged

3. Check to see that all safety devices are in place

4. Adjust track arm to make a right-hand, 45-degree cut; lock in place

5. Adjust saw blade so that it is slightly lower than bottom surface of stock

JOB SHEET #3

6. Plug saw into power source, making sure that saw is grounded
7. Put on safety goggles
8. Check with instructor for approval before starting saw
9. Start saw and let it gain maximum speed
10. Place molding on saw table against fence
11. While holding molding tightly against fence, pull saw forward to cut a right-hand miter at the extreme left end of molding
12. Turn off saw immediately after cut is made, and press down on brake button to stop blade; return saw to its starting position
13. Measure and mark molding at proper length (established by instructor)
14. Unlock and readjust track arm to make a left-hand, 45-degree cut; lock in place
15. Place molding against fence on saw table, aligning mark with blade
16. Check to see that blade is behind fence and clear of molding before starting saw
17. Start saw and let it gain maximum speed
18. While holding trim tightly against fence, pull saw forward to cut a left-hand miter at the established mark
19. Turn off saw immediately after making cut, and press down on brake button to stop blade; return saw to its starting position
20. Following the same procedure, cut another piece of molding exactly the same size as the first and with the same miters
21. Lay the two pieces on a flat work table, and fit the two angles together
22. Use try square to check angle formed by the two pieces

    (NOTE: If the angle is 90 degrees, the cut is good; if not, you will have to readjust saw and try again.)

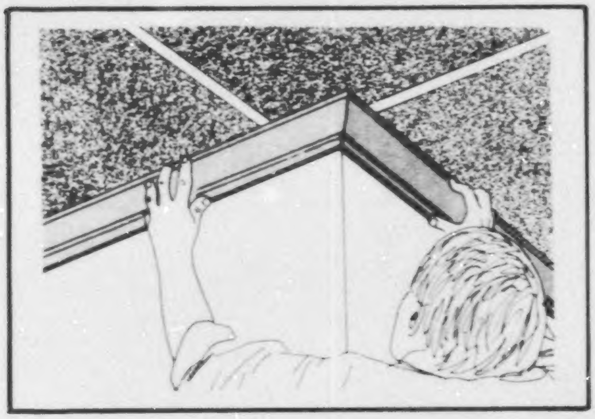
23. Discard scrap in proper receptacle
24. Remove safety goggles

    (NOTE: If the compound miter cut is made immediately, it will not be necessary to unplug saw from power source or to repeat steps 1 through 3.)

JOB SHEET #3

B. Compound miter cut, outside corner (Figure 38)

FIGURE 38

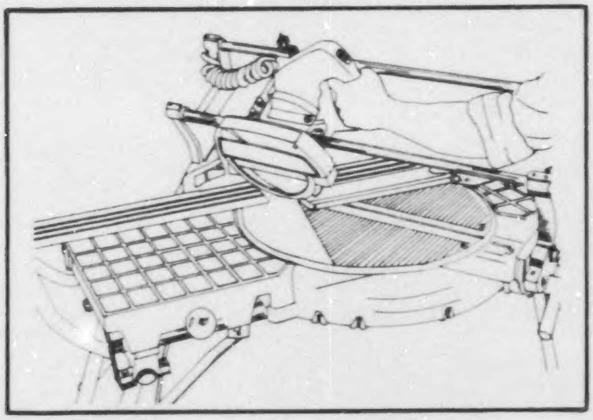


Used with permission of Delta International Machinery Corp., Pittsburgh, Pennsylvania.

1. Adjust track arm to 34¼-degree right-miter position

2. Tilt saw blade to 30-degree bevel position (Figure 39)

FIGURE 39



Used with permission of Delta International Machinery Corp., Pittsburgh, Pennsylvania.

3. Place molding against fence

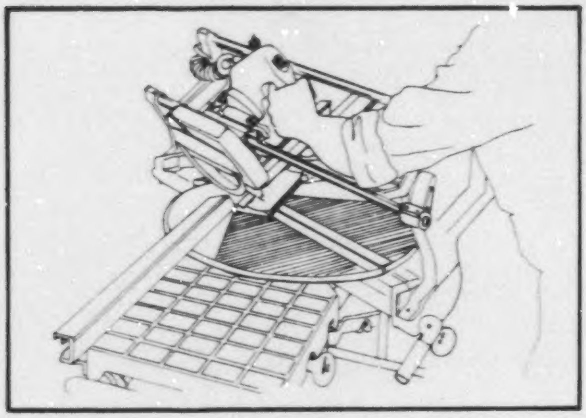
4. Put on safety goggles

5. Check to see that blade is behind fence and clear of molding before starting saw

JOB SHEET #3

6. Check with instructor for approval before starting saw
7. Start saw and let it gain maximum speed
8. While holding molding tightly against fence, move saw forward to make cut
9. Turn off saw immediately after cut is made, and press down on brake button to stop blade
10. Return saw to its starting position
11. Adjust track arm to 34¼-degree left-miter position (Figure 40)

FIGURE 40



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12. Place molding against fence
13. Check to see that blade is behind fence and is clear of molding before starting saw
14. Check with instructor for approval before starting saw
15. Start saw and let it gain maximum speed
16. While holding molding tightly against fence, move saw forward to make cut
17. Turn off saw immediately after cut is made, and press down on brake button to stop blade
18. Return saw to its starting position
19. Remove safety goggles

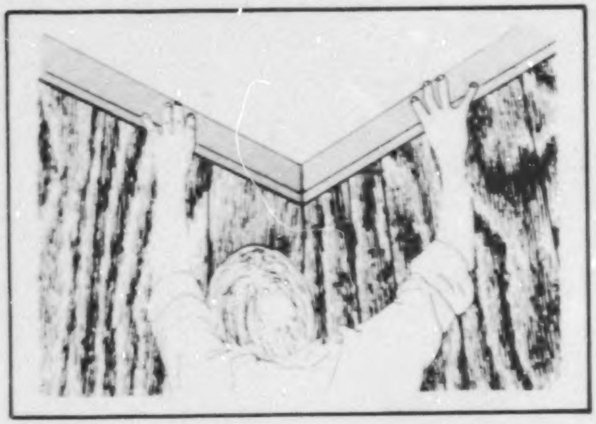
JOB SHEET #3

20. Discard scrap in proper receptacle

(NOTE: When cutting outside corners of crown molding following this procedure, the waste piece will always be on the left side of the saw blade.)

C. Compound miter cut, inside corner (Figure 41)

FIGURE 41

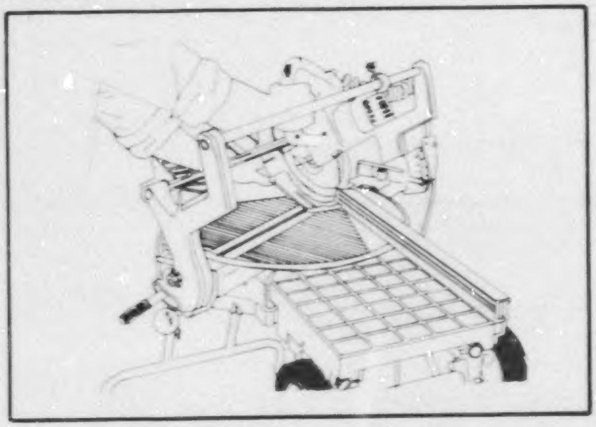


Used with permission of Delta International Machinery Corp., Pittsburgh, Pennsylvania.

1. Adjust track arm to 34¼-degree right-miter position

2. Tilt saw to 30-degree bevel position (Figure 42)

FIGURE 42



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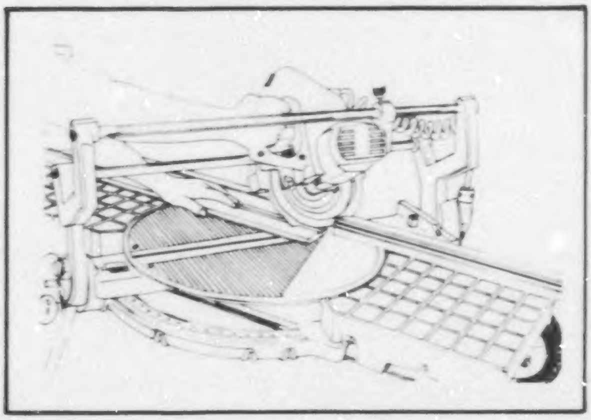
JOB SHEET #3

3. Place molding against fence
4. Put on safety goggles
5. Check to be sure that blade is behind fence and clear of molding before starting saw
6. Check with instructor for approval before starting saw
7. Start saw and let it gain maximum speed
8. While holding molding tightly against fence, move saw forward to make cut
9. Turn off saw immediately after cut is made, and press brake button to stop blade
10. Return saw to its starting position
11. Adjust track arm to 34¼-degree left-miter position (Figure 43)

FIGURE 43



Used with permission of Delta International Machinery Corp., Pittsburgh, Pennsylvania.

12. Place molding against fence
13. Check to see that blade is behind fence and clear of molding before starting saw
14. Check with instructor for approval before starting saw
15. Start saw and let it gain maximum speed

JOB SHEET #3

16. While holding molding tightly against fence, move saw forward to make cut

17. Turn off saw immediately after making cut, and press brake button to stop blade

18. Return saw to its starting position

19. Discard scrap in proper receptacle

    (NOTE: When cutting inside corners of crown molding following this procedure, the waste piece will always be on the right side of the saw blade.)

20. Unplug saw from power switch

21. Remove safety goggles

22. Clean up area and put away tools

POWER TOOLS
UNIT II

JOB SHEET #4 — OPERATE A POWER SANDER

I. Tools and equipment

- A. Safety goggles
- B. Combination belt-and-disc sander
- C. Sanding belts and discs of correct grades for rough and fine sanding
- D. Stock to be sanded
- E. Miter head (if needed)

II. Procedure for rough sanding

- A. Check to see that power is off
- B. Check to see that all safety devices are in place
- C. Install appropriate belt or disc for rough sanding
- D. Check adjustment of sander table
- E. Turn on power
- F. Mark off area on stock that is to be removed by sander
- G. Put on safety goggles
- H. Check with instructor for approval before starting sander
- I. Turn on sander
- J. Holding stock firmly on sanding table, move it into contact with sanding disc or belt
- K. After proper amount of stock is removed, turn off sander
- L. Remove safety goggles
- M. Inspect stock to see if enough material has been removed

(NOTE: If more sanding is needed, repeat steps H through M.)

JOB SHEET #4

- N. Turn off power
- O. Clean up area and put away tools

III. Procedure for fine sanding

- A. Check to see that power is off
- B. Check to see that all safety devices are in place
- C. Install appropriate belt or disc for fine sanding
- D. Follow same procedures as for rough sanding, steps D through O

POWER TOOLS
UNIT II

JOB SHEET #5 — DRILL AND BORE HOLES

I. Tools and equipment

   A. Safety goggles

   B. Drill press and chuck key

   C. Drills (various sizes) and forstner bit or multispur bit

   D. Drill vise or clamps

   E. Stock to be drilled

   F. Stock to be bored

   G. Blocks of scrap wood

II. Procedure for drilling

   A. Check to see that power is off

   B. Check to see that all safety devices are in place

   C. Install correct drill into chuck; tighten with chuck key; remove chuck key

   D. Adjust table to proper height

   E. Lay out hole on stock to be drilled

   F. Place a scrap block of wood on drill-press table

   (NOTE: This block of wood prevents the stock from splintering when the drill goes through the work, and will also prevent damage to the drill by not letting it reach the tool table.)

   G. Place stock on top of scrap block; adjust so that the drill will center on the layout mark

   H. Clamp stock firmly to drill-press table

   I. Recheck position by lowering drill to layout mark; readjust if necessary

   J. Check with instructor to be sure that proper drill speed is set for drill being used

   K. Turn on power

JOB SHEET #5

L. Put on safety goggles

M. Check with instructor for approval before starting drill press

N. Turn on drill press

O. Slowly but firmly lower drill into stock

P. Continue drilling into stock until hole is completed

(NOTE: When making deep cuts, it is a good policy to back the drill out of the work now and then to clear the wood chips from the drill.)

Q. Back drill out of hole

R. Turn off drill press

S. Remove safety goggles and inspect stock

T. Remove stock from drill press

U. Remove drill from drill press

(NOTE: If boring is to be done immediately, it will not be necessary to turn off power or to recheck safety devices.)

III. Procedure for boring

(NOTE: Boring is the process of cutting large holes in wood, but not in metal; drilling refers to small holes cut in wood or metal.)

A. Install proper boring tool into chuck; tighten with chuck key; remove chuck key

B. Adjust table to proper height

C. Lay out hole on stock to be bored

D. Place a scrap block of wood on drill-press table

E. Place stock on top of scrap block; adjust so that boring tool will center on the layout mark

F. Clamp stock firmly to drill-press table

G. Recheck position by lowering tool to layout mark; readjust if necessary

H. Check with instructor to be sure that proper boring speed is set for tool being used

JOB SHEET #5

I. Put on safety goggles

J. Check with instructor for approval before starting drill press

K. Turn on drill press

L. Slowly but firmly lower tool into stock

M. Continue boring until hole is completed

N. Back tool out of hole

O. Turn off drill press

P. Remove safety goggles and inspect stock

Q. Remove stock from drill press

R. Remove boring tool from drill press

S. Turn off power

T. Clean up area and put away tools and equipment

POWER TOOLS
UNIT II

JOB SHEET #6 — PERFORM JOINTING OPERATIONS

I. Tools and equipment

- A. Safety goggles
- B. Jointer with fence
- C. Square
- D. Rule or tape
- E. Push stick
- F. 1×4 stock about 18 inches long

II. Procedure for facing

(NOTE: Rough stock should always be faced before it is jointed.)

- A. Check to see that power is off
- B. Check to see that all safety devices are in place
- C. Adjust depth of cut to $^{1}/_{16}$ inch
- D. Check fence to see that it is at a right angle (90 degrees) to table
- E. Put on safety goggles
- F. Turn on power
- G. Place stock face against infeed table, edge against fence, and hold firmly

> **CAUTION**
>
> Be sure that both hands are clear of blade. One hand should be on top of stock near the front and the other on top near the rear.

- H. Check with instructor for approval before starting jointer
- I. Check to see that everyone is clear of jointer
- J. Start jointer and let it gain maximum speed
- K. Move stock forward; as stock passes onto outfeed table, keep pressure down evenly on both tables

JOB SHEET #6

L. Continue moving stock forward; as end of stock nears blade, use push stick to push stock through blade

M. Turn off jointer immediately after cut is made

N. Check stock to see whether it is straight and free of warp or hollow

(NOTE: It may be necessary to make additional cuts to face stock satisfactorily.)

O. Remove safety goggles

(NOTE: If edge jointing is to be done immediately, it will not be necessary to repeat steps A through D.)

III. Procedure for edge jointing

(NOTE: Edge jointing is done following the same procedure as for facing, except the cuts are made on the edge instead of the surface.)

IV. Procedure for beveling

A. Adjust table to proper depth of cut if necessary

B. Adjust fence to desired angle

C. Put on safety goggles

D. Place stock against fence, with surface flat on infeed table, and hold firmly

CAUTION

Be sure that both hands are clear of blade.

E. Check with instructor for approval before starting jointer

F. Check to see that everyone is clear of jointer

G. Start jointer and let it gain maximum speed

H. Move stock forward with an even downward pressure as it moves from infeed table to outfeed table

I. Turn off jointer immediately after cut is made

J. Remove safety goggles

(NOTE If rabbeting is to be done immediately, it will not be necessary to turn off power.)

JOB SHEET #6

V. Procedure for rabbeting

A. Remove blade guard

B. Slide fence toward blade until distance between fence and end of blade is the desired width of rabbet; then lock in place

C. Check fence to be sure it is at a right angle to table

D. Adjust infeed table to proper depth of cut (about 1/8 inch)

E. Put on safety goggles

F. Place stock against fence, with surface flat on infeed table, and hold firmly

CAUTION

Be sure that both hands are clear of blade.

G. Check with instructor for approval before starting jointer

H. Check to see that everyone is clear of jointer

I. Start jointer and let it gain maximum speed

J. Move stock forward to make cut

K. Continue making cuts, lowering infeed table in 1/8-inch increments, until desired depth of rabbet is obtained

L. Turn off jointer immediately after cut is made

M. Replace blade guard

N. Remove safety goggles

VI. Procedure for tapering

A. Mark surface of stock where taper starts and ends

B. Determine amount of stock to be removed (established by instructor), and mark amount of taper on end of stock

C. Check fence to be sure that it is at a right angle to table

D. Adjust infeed table to proper depth of cut

E. Position stock so that start of taper is directly above blade when blade is at its highest point

JOB SHEET #6

F. Place a block on feed table at end of stock, and clamp in place

(NOTE: The stop block is used when additional pieces are to be cut identical to the first piece. The stop block also supports rear of stock while front of stock is being lowered into blade.)

G. Put on safety goggles

H. Check with instructor for approval before starting jointer

I. Check to see that everyone is clear of jointer

J. Start jointer and let it gain maximum speed

K. Open the guard

L. Hold end of stock against stop block and fence while lowering end where taper starts into blade until it rests on outfeed table

M. Keeping end down on infeed table, move stock forward until other end of taper is reached

N. Turn off jointer immediately after cut is made

O. Carefully raise stock away from blades

P. Turn off power

Q. Remove safety goggles

R. Clean up area and put away tools

POWER TOOLS
UNIT II

JOB SHEET #7 — PERFORM FACE-PLANING OPERATION

I. Tools and equipment

   A. Safety goggles and ear protection (if necessary)

   B. Power plane

   C. Blades

   D. Stock to be planed

   (NOTE: Stock material must be long enough to reach the outfeed rollers before it leaves the infeed rollers. Check stock to be sure that it is free of nails or other objects that may damage machine or be dangerous to operator.)

II. Procedure for face planing

   A. Check to see that power is off

   B. Check to see that all safety devices are in place

   C. Adjust plane to proper depth of cut (given by instructor)

   (NOTE: Planes may remove as much as ½ inch with each pass, but ⅛ inch is the average cut.)

   D. Put on safety goggles

   E. Turn on power

   F. Check with instructor for approval before starting plane

   G. Check to see that everyone is clear of plane

   H. Start plane

   I. Adjust power feed

   J. Feed stock into plane, keeping a firm grip on stock and keeping hands clear of blades

   K. Go around machine and support stock as it feeds out of plane

   L. Turn off plane

JOB SHEET #7

M. Check thickness of stock

(NOTE: If there is a difference in thickness or if more needs to be removed from stock piece, readjust gauge and run piece through again.)

N. Turn off power

O. Remove safety goggles

P. Clean area and put away tools and equipment

POWER TOOLS
UNIT II

JOB SHEET #8 — PERFORM EDGE-SHAPING OPERATION

I. Tools and equipment

A. Safety goggles

B. Shaper with fence

C. Cutters

D. Push block and hold-down devices

E. Necessary wrenches

F. Miter head

G. Stock to be shaped

(NOTE: Stock must be at least 10 inches long. Examine carefully for defects.)

II. Procedure for edge shaping

A. Check to see that power is off

B. Check to see that all safety devices are in place

C. Install desired shaper cutter

(NOTE: Installation should be done only under the strict supervision of the instructor.)

D. Adjust blade to appropriate height

E. Install and adjust fence

F. Be sure that direction of feed and rotation of spindle are correct

(NOTE: Always rotate the spindle by hand to make sure that it clears all guards, fences, or other parts of shaper.)

G. Turn on power

H. Put on safety goggles

I. Check with instructor for approval before starting shaper

J. Check to see that everyone is clear of shaper

JOB SHEET #8

K. Start shaper

L. Make a small cut on end of a scrap piece of stock

M. Turn off shaper

N. Check cut end to see whether it is cut as desired

O. Make adjustments to fence and height of spindle if necessary

P. Cover spindle with guard; install hold-down devices

Q. Start shaper

R. Hold stock firmly, and feed into shaper *against* rotation of blade, maintaining an even rate of speed to obtain a smooth cut

> **CAUTION**
> Keep hands at least 4 inches from cutters.

S. Turn off shaper immediately after cut is made

T. Turn off power

U. Remove safety goggles

V. Clean up area and put away tools and equipment

POWER TOOLS
UNIT II

JOB SHEET #9 — OPERATE A PNEUMATIC FASTENER

I. Tools and equipment

  A. Safety goggles

  B. Pneumatic fastener

  C. Electric air compressor with air hose

  D. Fasteners (nails) designed for fastener being used

  E. Two 2×4s, 4 feet long

  F. Manufacturer's instruction manual

II. Procedure

  A. Check to see that all safety devices are in place

  B. Plug air compressor into power source

  C. Put on safety goggles

  D. Start air compressor

  E. Adjust regulator to pressure specified by manufacturer for material being used

  F. Load fastener with nails

  G. Hold fastener so that discharge end is pointed down and away from anyone

  H. Connect air hose to fastener

> **CAUTION**
>
> Be very cautious when connecting air hose to fastener because fastener may discharge at the time of connection.

  I. Check with instructor for approval before using fastener

  J. Check to see that everyone is clear of fastener

  K. Position fastener firmly on stock to be connected and pull trigger

  L. Continue discharging nails until project is complete

JOB SHEET #9

M. Disconnect air hose from fastener

N. Turn off air compressor and disconnect from power source

O. Remove safety goggles

P. Clean up area and put away tools and equipment

POWER TOOLS
UNIT II

JOB SHEET #10 — SAFELY LOAD AND USE A POWDER-ACTUATED TOOL

I. Tools and equipment

A. Safety goggles

B. Hard hat

C. Powder-actuated tool

D. Lubricant

E. Supply of fasteners

F. Supply of boosters

G. Stock to be fastened

H. Manufacturer's instruction manual

II. Operating precautions

(NOTE: Review the safety precautions below *before* attempting the following procedure.)

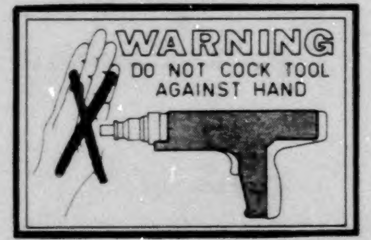
A. Before attempting to use powder-actuated tool, read instruction manual for particular tool you are using

B. Never load tool until you are ready to use it

C. Always insert fastener before cocking tool

D. Never cock tool against your hand (Figure 44)

FIGURE 44



Used with permission of Hilti Fastening Systems, Tulsa, Oklahoma.

JOB SHEET #10

E. Never hold your hand behind material you are fastening

F. Never point tool at anyone

G. If booster fails to ignite, keep tool against work surface for thirty seconds

H. Never attempt to pry a booster out of magazine strip

I. Never leave a loaded tool unattended

J. Use rubber stabilizer whenever possible

K. Always wear safety goggles and hard hat when operating tool

L. Use ear protection in confined area

M. Never use a defective tool

III. Procedure

(NOTE: Do not perform the following procedure until you have received your qualified operator's card, signifying that you have been trained and are certified to use a powder-actuated tool.)

A. Put on your hard hat

B. Put on safety goggles

C. Remove tool from toolbox

D. Insert fastener, point out, into guide until it is held in place by plastic washer (Figures 45 and 46)

FIGURE 45

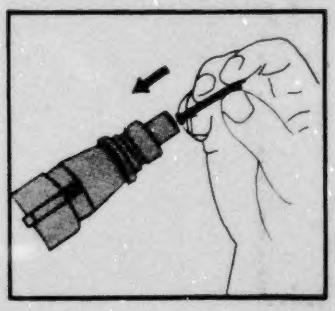
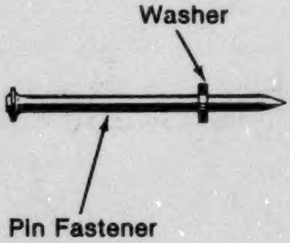


FIGURE 46

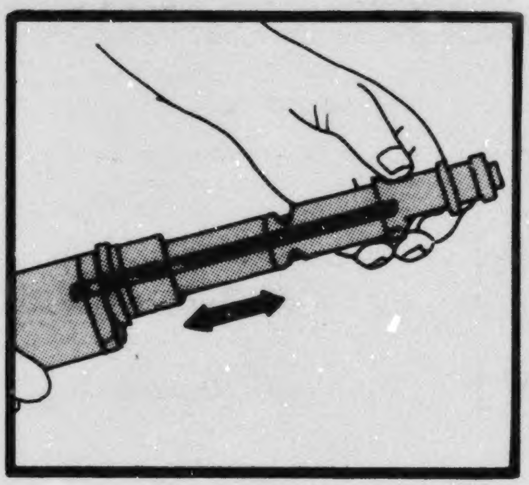


Figures 45 and 46 adapted with permission of Hilti Fastening Systems, Tulsa, Oklahoma.

JOB SHEET #10

E. In one movement, cock tool by pulling out baseplate and piston sleeve to the top; then push back again to the stop (Figure 47)

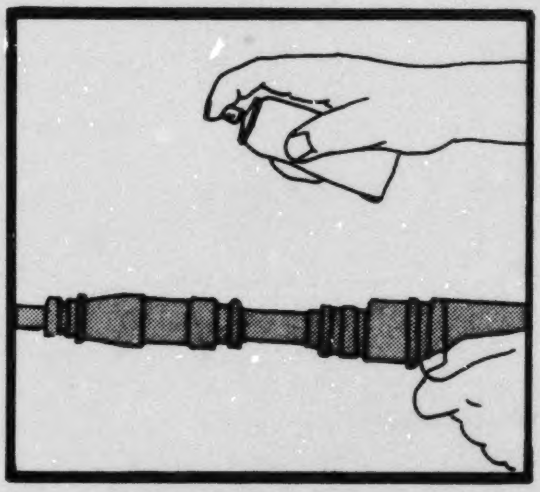
FIGURE 47



Used with permission of Hilti Fastening Systems, Tulsa, Oklahoma.

(NOTE: If baseplate and piston sleeve movement is stiff, lightly spray the outer surface of the piston sleeve with lubricant [furnished with tool], and then slide the unit in and out several times. Clean tool daily. See Figure 48.)

FIGURE 48



Used with permission of Hilti Fastening Systems, Tulsa, Oklahoma.

JOB SHEET #10

F. Insert booster magazine into base of hand grip; slide it in completely until it is flush with bottom of grip (Figures 49 and 50)

(NOTE: Boosters are color coded according to power levels. Use guide in tool kit to determine correct booster for the job being done. Always insert booster magazine from *bottom* of the grip and remove from the *top* of tool.)

FIGURE 49

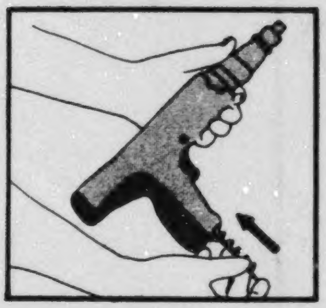
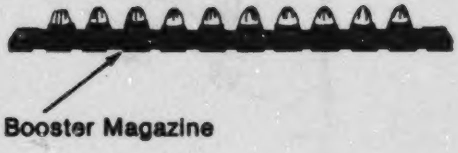


FIGURE 50

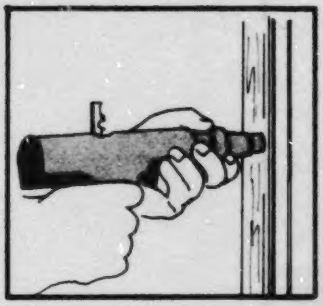


Figures 49 and 50 adapted with permission of Hilti Fastening Systems, Tulsa, Oklahoma.

G. Press tool firmly and squarely against work surface and squeeze trigger (Figure 51)

(NOTE: Tool must be perpendicular to work surface for best results.)

FIGURE 51



Used with permission of Hilti Fastening Systems, Tulsa, Oklahoma.

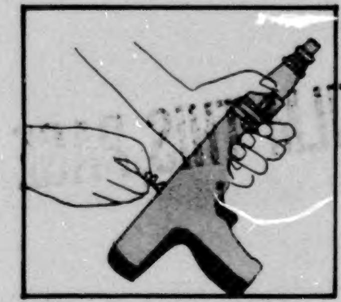
H. Repeat steps D, E, and G until magazine is exhausted (ten boosters) or job is completed

JOB SHEET #10

I. Unload tool by pulling magazine out from the *top* of tool body (Figure 52)

> **CAUTION**
>
> Tool must always be unloaded before work breaks, changing parts, cleaning, servicing, or storing.

FIGURE 52



Used with permission of Hilti Fastening Systems, Tulsa, Oklahoma.

J. Inspect breech for foreign particles

(NOTE: Breech must be inspected after each magazine is removed.)

K. Clean tool at end of workday

L. Return tool to toolbox and store

POWER TOOLS
UNIT II

TEST

NAME ____ SCORE ________________

1. Match to their correct definitions terms associated with power tools. Write the correct numbers in the blanks.

_____a. Sharp, violent reaction of tool as it rejects material being forced into it

_____b. Type of molding made by cutting or routing close-spaced, parallel, half-round, convex profiles; process of cutting or routing such profiles

_____c. Safety device used to push material through cutters to protect fingers from being cut

_____d. Rabbet or groove cut in wood

_____e. Groove cut in surface or edge of a board to receive another board similarly cut

_____f. Concave channel or groove cut into wood

_____g. Edge of board beveled at 45-degree angle; may be angular or curved

_____h. Fastener used in a powder-actuated tool

_____i. Interlocking joint

_____j. Holder or stand used to hold door on edge while planing, routing, or installing hinges

_____k. Powder load used to project fasteners in powder-actuated tools

_____l. Interior cut that removes a middle section of stock

_____m. Cut in stock that keeps blade from binding

_____n. Cutout area or depression made to receive something such as hinges on doors

_____o. Slant or inclination on a surface

_____p. Cutting thick pieces of stock to make two or more thinner pieces

1. Rabbet
2. Chamfer
3. Dado
4. Bevel
5. Door jack
6. Dovetail
7. Flute
8. Booster
9. Push stick
10. Mortise
11. Kickback
12. Drive pin
13. Relief cut
14. Pocket cut
15. Reeding
16. Resawing

TEST

2. State seven general safety rules pertaining to power tools.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

f. ______________________________

g. ______________________________

3. Select from the following list general guidelines for proper care of power tools. Write an "X" in the blank before each correct answer.

_____a. Keep machine surfaces clean and oiled

_____b. Keep all tool accessories, such as blades and bits, sharp

_____c. Inspect tools and accessories yearly

_____d. Keep tools clean and in good working order

_____e. *Do not* follow manufacturer's maintenance procedures

_____f. Report any unusual noises, sounds, or vibrations to the instructor or supervisor

_____g. Use appropriate blade for the job being done, even if it is not the correct size for the arbor

_____h. Protect cutting edges

_____i. Keep tools in your trunk or in back of pickup when not in use

4. Select from the following list uses of a table saw. Write an "X" in the blank before each correct use.

_____a. Dadoing

_____b. Making irregular cuts

_____c. Crosscutting

_____d. Cutting inside curves

_____e. Rabbeting

_____f. Mitering

TEST

5. State four rules for safe use of table saws.

a. ____

____

b. ____

____

c. ____

____

d. ____

____

6. Select from the following list uses of a radial arm saw. Write an "X" in the blank before each correct use.

______a. Cutting molding

______b. Crosscutting

______c. Mitering

______d. Making scroll cuts

______e. Making pocket cuts

______f. Rabbeting

7. State four rules for safe use of radial arm saws.

a. ____

____

b. ____

____

c. ____

____

d. ____

____

TEST

8. Select from the following list uses of a jointer. Write an "X" in the blank before each correct use.

_____a. Chamfering

_____b. Face planing

_____c. Sawing circles

_____d. Mitering

_____e. Tapering

_____f. Straightening

9. State four rules for safe use of jointers.

a. ____________________

____

b. ____________________

____

c. ____________________

____

d. ____________________

____

10. Select from the following list uses of a power plane. Write an "X" in the blank before each correct use.

_____a. Beveling

_____b. Dovetailing

_____c. Mitering

_____d. Mortising

_____e. Face planing

_____f. Tapering

11. State two rules for safe use of power planes.

a. ____________________

____

b. ____________________

____

TEST

12. Select from the following list uses of a shaper. Write an "X" in the blank before each correct use.

______a. Flat planing

______b. Fluting

______c. Shaping edges

______d. Grooving

______e. Sanding

______f. Bevel cutting

13. State four rules for safe use of shapers.

a. ______________________________

____

b. ______________________________

____

c. ______________________________

____

d. ______________________________

____

14. Select from the following list uses of a table band saw. Write an "X" in the blank before each correct use.

______a. Resawing (ripping)

______b. Mitering

______c. Making relief cuts

______d. Making irregular cuts

______e. Making compound miters

______f. Sawing circles

15. State two rules for safe use of table band saws.

a. ______________________________

b. ______________________________

16. Select from the following list uses of a bench grinder. Write an "X" in the blank before each correct use.

______a. Sharpening saw blades

______b. Removing paint from steel

______c. Smoothing mitered edges of trim

______d. Grinding burrs and rough places from steel

______e. Grinding and shaping steel

______f. Sharpening tools

TEST

17. State three rules for safe use of bench grinders.

a. ____

b. ____

c. ____

18. Select from the following list uses of a drill press. Write an "X" in the blank before each correct use.

______a. Grinding

______b. Tapping

______c. Mortising

______d. Sanding

______e. Cutting holes with hole saw

______f. Shaping

19. State two rules for safe use of drill presses.

a. ____

b. ____

20. Select from the following list uses of a combination belt-and-disc sander. Write an "X" in the blank before each correct use.

______a. Grinding glass

______b. Cleaning paint from trim

______c. Grinding burrs off steel

______d. Fine sanding

______e. Shaping

______f. Rough sanding

21. State two rules for safe use of combination belt-and-disc sanders.

a. ____

____

b. ____

____

22. Select from the following list uses of a power miter saw. Write an "X" in the blank before each correct use.

______a. Cutting compound miters

______b. Cutting circles

______c. Ripping

______d. Crosscutting

______e. Cutting straight miters

______f. Beveling

TEST

23. State two rules for safe use of power miter saws.

a. ____

b. ____

24. Select from the following list uses of a sawbuck. Write an "X" in the blank before each correct use.

______a. Ripping

______b. Crosscutting

______c. Making compound miter cuts

______d. Cutting pockets

______e. Making bevel cuts

______f. Making straight miter cuts

25. State two rules for safe use of sawbucks.

a. ____

b. ____

26. Distinguish between uses of a portable angle grinder and a belt sander. Write an "AG" in the blanks before uses of an angle grinder, and a "BS" in the blanks before uses of a belt sander. Some blanks may contain more than one answer.

________a. Grinding metal

________b. Polishing and buffing

________c. Grinding glass

________d. Smooth sanding

________e. Grinding concrete

________f. Rough sanding

________g. Wire brushing

________h. Removing rust and scale from steel

27. State rules for safe use of portable angle grinders and belt sanders.

Angle grinder (State two rules.)

a. ____

b. ____

Belt sander (State two rules.)

a. ____

b. ____

TEST

28. Distinguish among uses of portable power saws. Write a "C" in the blanks before uses of circular saws, and "R" in the blanks before uses of reciprocating saws, a "J" in the blanks before uses of jigsaws, and a "B" in blanks before uses of band saws. Some blanks may contain more than one answer.

________a. Crosscutting

________b. Ripping

________c. Cutting pipe

________d. Making curves and scroll cuts

________e. Making irregular cuts

________f. Making miter cuts

________g. Cutting angle iron and steel rods

________h. Making bevel cuts

________i. Making pocket cuts

________j. Making inside curves and corner cuts

________k. Cutting metal studs

________l. Making relief cuts

29. State rules for safe use of the following portable power saws.

Circular saw (State four rules.)

a. ____

b. ____

c. ____

d. ____

Reciprocating saw and jigsaw (State two rules.)

a. ____

b. ____

Band saw (State two rules.)

a. ____

b. ____

TEST

30. Distinguish between uses of a router and a trimmer. Write an "R" in the blanks before uses of a router, and a "T" in the blanks before uses of a trimmer.

_____a. Cutting obtuse and acute angles
_____b. Dadoing, fluting, and reeding
_____c. Flush trimming
_____d. Rabbeting
_____e. Bevel trimming
_____f. Shaping edges
_____g. Dovetailing
_____h. Cutting laminate
_____i. Beveling
_____j. Mortising

31. State three rules for safe use of routers and trimmers.

a. ____

____

b. ____

____

c. ____

____

32. Distinguish among uses of a portable drill, screwdriver, and hammer drill. Write a "D" in the blanks before uses of a drill, an "S" before uses of a screwdriver, and an "H" before uses of a hammer drill. Some blanks may contain more than one answer.

________a. Setting anchors
________b. Boring and drilling
________c. Drilling holes in masonry and concrete
________d. Driving and removing lag bolts
________e. Driving screws
________f. Drilling holes in wood and other materials
________g. Cutting holes with hole saw
________h. Performing light chipping work
________i. Driving and removing wood screws
________j. Mixing materials
________k. Driving and removing machine screws
________l. Driving and removing thread-cutting screws

TEST

33. State rules for safe use of portable drills, screwdrivers, and hammer drills.

Portable drill and hammer drill (State four rules.)

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

Screwdriver (State two rules.)

a. ______________________________

b. ______________________________

34. Select from the following list uses of a portable power plane. Write an "X" in the blank before each correct use.

______a. Mitering

______b. Chamfering

______c. Straightening material

______d. Beveling

______e. Edge planing

______f. Face planing

35. State two rules for safe use of portable power planes.

a. ______________________________

b. ______________________________

36. Distinguish between uses of a rotary hammer and a chipping hammer. Write an "R" in the blanks before uses of a rotary hammer, and a "C" in the blanks before uses of a chipping hammer.

______a. Chipping masonry and concrete

______b. Setting anchors

______c. Bushhammering concrete

______d. Performing light chipping work

______e. Drilling holes in masonry and concrete

37. State two rules for safe use of rotary and chipping hammers.

a. ______________________________

b. ______________________________

TEST

38. Select from the following list uses of metal shears. Write an "X" in the blank before each correct use.

______a. Cutting metal pipe

______b. Cutting steel bars

______c. Cutting metal straps

______d. Cutting special lightweight materials

______e. Cutting angle iron

______f. Cutting sheet metal

39. State two rules for safe use of metal shears.

a. ____

____

b. ____

____

40. Distinguish between uses of pneumatic fasteners. Write an "N" in the blanks before uses of nailers, and an "S" in the blanks before uses of staplers. Some blanks may contain more than one correct answer.

________a. Applying decking

________b. Installing finish work

________c. Applying sheathing

________d. Applying roofing

________e. Installing paneling

________f. Installing ceiling tile

________g. Installing framing

________h. Installing insulation

41. State three rules for safe use of pneumatic fasteners.

a. ____

____

b. ____

____

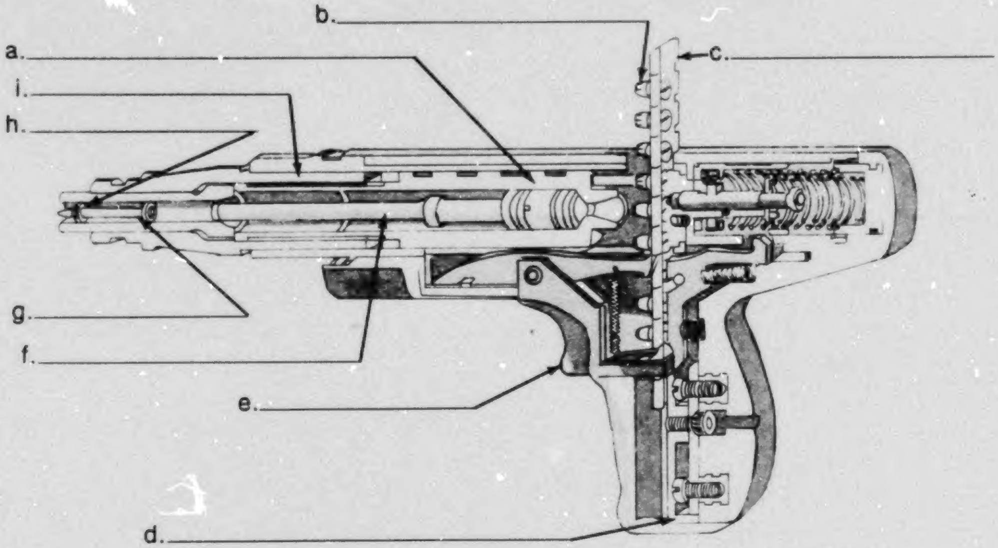
c. ____

____

TEST

42. Identify the parts of the powder-actuated tool illustrated below. Write the correct names in the blanks.

Trigger
Piston
Booster
Booster magazine
Fastener guide
Magazine loading chamber
Piston sleeve
Base plate
Fastener



43. Select from the following list uses of a powder-actuated tool. Write an "X" in the blank before each correct use.

_____a. Fastening steel to steel

_____b. Fastening studs to plates

_____c. Driving pins and threaded studs

_____d. Installing flooring

_____e. Fastening wood to concrete, masonry, and steel

_____f. Fastening steel to concrete

44. State rules for safe use of powder-actuated tools.

a. ____

b. ____

c. ____

d. ____

e. ____

TEST

f. ______________________________

g. ______________________________

h. ______________________________

i. ______________________________

j. ______________________________

45. Match circular-saw blades to their correct uses. Write the correct numbers in the blanks. Some blanks may contain more than one answer.

______________a. General-purpose use

______________b. Mitering

______________c. Finish cabinet work

______________d. Crosscutting

______________e. Ripping

1. Master combination blade (48 to 60 teeth)
2. Hollow-ground plane (miter) blade (48 to 60 teeth)
3. Chisel-tooth combination blade (24 to 30 teeth)
4. Crosscut-flooring blade (10 to 100 teeth)
5. Combination rip blade (36 to 44 teeth)

(NOTE: Test questions 46 and 47 list the assignment and job sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

46. Complete a safety test for specific tools.

47. Demonstrate the ability to

    a. Perform straight and angle cut-off operations.

    b. Perform ripping operations.

    c. Make miter and compound miter cuts.

    d. Operate a power sander.

    e. Drill and bore holes.

    f. Perform jointing operations.

TEST

g. Perform face-planing operations.

h. Perform edge-shaping operations.

i. Operate a pneumatic fastener.

j. Safely load and use a powder-actuated tool.

POWER TOOLS
UNIT II

ANSWERS TO TEST

1. a. 11
   b. 15
   c. 9
   d. 3
   e. 1
   f. 7
   g. 2
   h. 12
   i. 6
   j. 5
   k. 8
   l. 14
   m. 13
   n. 10
   o. 4
   p. 16

2. Answer should include any seven of the following

   a. Do not attempt to operate any power tool before being checked out by instructor on that particular tool
   b. Always wear eye protection and hard hat when operating a power tool
   c. Wear appropriate clothing for job being done
   d. Do not distract others or let anyone distract you while operating a power tool
   e. Do not leave power tool running unattended
   f. Assume a safe and comfortable position before using a power tool
   g. Be sure that power tool is properly grounded before using
   h. Be sure that power tool is disconnected before performing maintenance or changing accessories
   i. Do not use dull or broken tool or accessories
   j. Use a power tool only for its intended use
   k. Keep feet, fingers, and hair away from the blade and other moving parts of a power tool
   l. Do not use a power tool with guards or safety devices removed
   m. Do not operate a power tool if hands or feet are wet
   n. Keep work area clean at all times
   o. Before attempting to use it, be familiar with the correct operation and adjustments of power tool
   p. Keep a firm grip on the power tool at all times
   q. Use electric extension cords of sufficient size to service particular power tool you are using

3. b, d, f, h

4. a, c, e, f

5. Answer should include any four of the following

   a. Keep guard over blade while machine is being used
   b. Do not stand directly in line with blade
   c. Make sure that blade does not project more than $^1/_8$ inch above stock being cut
   d. Never reach across saw blade
   e. Use a push stick for ripping all stock less than 4 inches wide

ANSWERS TO TEST

f. Enlist a helper to support long or wide stock
g. Before cutting stock to length using miter gauge and rip fence, clamp on a step block for clearance
h. Do not rip without rip fence, or crosscut without miter gauge
i. When blade is tilted, be sure that blade will clear stock before turning on machine
j. Be sure that stock has a straight edge before ripping
k. Do not rip cylindrical stock on a circular saw
l. When using a dado or molding head, take extra care to hold stock firmly
m. Use proper blade for the job being done

6. a, b, c, f

7. Answer should include any four of the following

   a. Make sure that saw is set at proper depth before turning it on
   b. Use only a sharp and properly set blade
   c. Use the proper blade for the job being done
   d. Do not stand directly in line with blade
   e. Make sure that saw has attained maximum speed before starting the cut
   f. Do not let saw feed too fast when crosscutting heavy stock
   g. When ripping, follow the same safety rules as those for using table saw
   h. Always use antikickback guard when ripping
   i. Do not feed or pull stock too fast when ripping because this will jam the saw
   j. When ripping, feed stock against direction of blade rotation
   k. Do not stop blade by forcing scrap wood into blade

8. a, b, e, f

9. Answer should include any four of the following

   a. Keep guard over knives at all times while operating jointer
   b. Adjust depth of cut before power is turned on
   c. Do not use stock less than 12 inches long
   d. Do not use strips less than 1 inch wide
   e. Use push stick or push block when jointing narrow or flat pieces of stock
   f. Secure clamping screws tightly on fence so that fence will not slip while in use
   g. Do not start the cut until jointer has gained its maximum speed
   h. Keep fingers as high as possible on stock, and *never* drag thumb at back of stock
   i. Avoid taking cuts deeper than 1/8 inch; too deep a cut can cause kickbacks
   j. When passing work over jointer, change position of hands so that they will never be directly over knives
   k. Follow through with stock and allow guard to return to closed position
   l. Do not attempt to plane discs or other pieces that cannot be held securely against fence

ANSWERS TO TEST

10. a, e, f

11. Answer should include any two of the following

    a. Keep hands clear of blades
    b. Keep a firm grip on stock
    c. Do not attempt to remove too much material with one cut
    d. Make adjustments only after power has been disconnected
    e. Check stock to be sure that it is free of nails or other objects that may damage machine or be dangerous to operator

12. b, c, d

13. Answer should include any four of the following

    a. Whenever possible, install cutter so that bottom of stock is shaped; in this way, the stock will cover most of cutter and act as a guard
    b. Be sure that cutter is locked securely to spindle
    c. Always position fences so that they will support work that has passed the cutters
    d. Adjust spindle for correct height and lock in position; rotate spindle by hand to be sure that it clears all guards and fences
    e. Check direction of rotation by snapping switch on and off; watch as cutter comes to rest
    f. *Always* feed *against* the cutting edge
    g. Examine stock carefully for defects before cutting; never cut through a loose knot or through stock that is cracked or split
    h. Hold stock down and against fence with hands on top of material, yet out of range of cutters
    i. Use all guards, jigs, and clamping devices whenever possible
    j. Do not set spring hold-down clips too tightly against work; use just enough tension to hold work against fence
    k. Always use a depth collar when shaping irregular work; use a guide pin in table to start the cutting
    l. Swing work into cutters when depth collars and guide pin are used for contour work
    m. Never shape a piece shorter than 10 inches

14. a, c, d, f

15. Answer should include any two of the following

    a. Use proper blade size to avoid breakage
    b. Do not feed stock too fast
    c. Use relief cuts when necessary
    d. Adjust saw guide before each cut

ANSWERS TO TEST

16. d, e, f

17. Answer should include any three of the following

    a. Always use tool rest
    b. Do not use grinder for woods or plastics
    c. Never wear gloves when using bench grinder
    d. Never use grinder with a cracked or damaged wheel
    e. Never force stock into grinding wheel
    f. Never use grinder to remove paint

18. a, b, c, d, e, f

19. Answer should include any two of the following

    a. Always remove chuck key before turning on power
    b. Secure stock before drilling
    c. Use correct speed for job being performed
    d. Do not force drill into stock
    e. Never wear gloves when operating a drill press

20. a, d, e, f

21. Answer should include any two of the following

    a. Hold stock firmly with both hands when feeding into sander
    b. Do not force stock against abrasive surface
    c. Do not use on plastics or other materials that may damage the sanding surfaces

22. d, e

23. Answer should include any two of the following

    a. Do not attempt to cut oversized stock
    b. Enlist a helper to support end of long stock
    c. Turn off motor immediately after making cut

24. b, c, e, f

ANSWERS TO TEST

25. Answer should include any two of the following

    a. Hold stock firmly against fence
    b. Clamp stock to fence when possible
    c. Allow motor to gain full speed before starting cut
    d. Never reach around or across saw blade
    e. Turn off motor immediately after making cut, and press down on brake button

26.

a.	AG	c.	BS	e.	AG	g.	AG
b.	AG	d.	BS	f.	AG, BS	h.	AG

27. Answer should include any two for each of the following

    Angle grinder

    a. Wear gloves when appropriate
    b. Use proper grinding head for material being ground
    c. Be sure that grinder head has stopped turning before laying grinder down

    Belt sander

    a. Keep power cord away from sander belt
    b. Hold sander firmly with both hands
    c. Be sure that sander has stopped running before laying it down

28.

a.	C, R, J	d.	J	g.	B	j.	R, J
b.	C, J	e.	R	h.	C	k.	B
c.	B	f.	C	i.	C, R, J	l.	R, J

29. **Circular saw** (Answer should include any four of the following)

    a. Keep electric cord clear of blade to avoid cutting cord
    b. Be sure that automatic guard is free and retractable
    c. Check stock for nails and any other metal before cutting
    d. Use a good, solid support for stock while cutting
    e. Allow saw to gain maximum speed before starting cut
    f. Set blade only deep enough to cut through stock
    g. Lay saw on its side after finishing the cut

    Reciprocating saw and jigsaw (Answer should include any two of the following)

    a. Keep electric cord clear of blade to avoid cutting cord
    b. Use the correct blade for the job being done
    c. Do not force blade into stock
    d. Turn off motor immediately after finishing the cut

ANSWERS TO TEST

Band saw (Answer should include any two of the following)

a. Use proper blade size to avoid breakage
b. Use correct blade for job being done
c. Do not force blade into stock

30. a. T
b. R
c. T
d. R
e. T
f. R
g. R
h. T
i. R
j. R

31. Answer should include any three of the following

a. Avoid making cuts too deep for tool being used
b. Be sure that stock is secured properly before routing
c. Always use a door jack when routing for door hinges
d. Always use jigs and guides with router; never rout or plow freehand
e. When using a router or trimmer, approach workpiece gently; never gouge bit into stock

32. a. H
b. D
c. H
d. S
e. D
f. H
g. D
h. H
i. S
j. D, H
k. S
l. S

33. **Portable drill and hammer drill** (Answer should include four of the following)

a. Always remove chuck key before starting drill
b. Never attempt to use auger bits designed for a hand brace
c. Never attempt to stop drill by taking hold of chuck
d. Do not force drill into stock
e. On deep cuts, back drill out often to clean out hole
f. Never point drill at anyone

Screwdriver (Answer should include two of the following)

a. Use correct type and size bit for screws being used
b. Never place screw point against any part of your body
c. Never hold your hand behind material into which you are driving the screw

34. b, c, d, e, f

ANSWERS TO TEST

35. Answer should include any two of the following

    a. Be sure that stock is secure before planing
    b. Keep hand or hands in their proper location on plane
    c. Always use a door jack when planing door edges

36. a. C
    b. R
    c. C
    d. R
    e. R

37. Answer should include any two of the following

    a. Never point hammer at anyone while it is running
    b. Keep feet and hands clear of tool
    c. Do not use point or chisel for prying

38. c, d, f

39. Answer should include any two of the following

    a. Never force tool into stock
    b. Do not attempt to cut stock that is too thick
    c. Keep fingers away from sharp edges of stock being cut

40. a. N, S
    b. N
    c. N, S
    d. S
    e. S
    f. S
    g. N
    h. S

41. Answer should include any three of the following

    a. Use pressure specified by manufacturer
    b. Use only nails or staples designed for fastener being used
    c. Use caution when attaching fastener to air supply because fastener may discharge
    d. Keep hands and body away from discharge end of fastener
    e. Do not discharge fasteners except when actually nailing or stapling
    f. Never point fasteners at anyone
    g. Never use fasteners on soft or thin material that nails may go through

ANSWERS TO TEST

42. a. Piston sleeve
    b. Booster
    c. Booster magazine
    d. Magazine loading chamber
    e. Trigger
    f. Piston
    g. Fastener
    h. Fastener guide
    i. Base plate

43. a, c, e, f

44. a. Do not use powder-actuated tool until you are certified
    b. Follow *all* safety precautions in manufacturer's instruction manual
    c. *Always* wear safety goggles and hard hat when operating tool
    d. Use proper pin size for the job you are performing
    e. Use correct booster according to selector chart in toolbox
    f. Never hold end of barrel against any part of your body, or cock tool against your hand
    g. Never hold hand behind material you are fastening
    h. Do not shoot close to edge of concrete
    i. Never attempt to pry booster out of magazine with sharp instrument
    j. Always wear ear protection in confined area

45. a. 1, 3, 5
    b. 1, 2, 3, 4, 5
    c. 2
    d. 1, 2, 3, 4, 5
    e. 1, 2, 3, 5

46. Evaluated to the satisfaction of the instructor

47. Performance skills evaluated to the satisfaction of the instructor

MISCELLANEOUS EQUIPMENT
UNIT III

UNIT OBJECTIVE

After completing this unit, the student should be able to identify miscellaneous equipment used by carpenters and to state and observe safety rules pertaining to such equipment. The student should also be able to set up a section of scaffolding and use a bench grinder. The student will show this knowledge by completing the assignment sheet, job sheets, and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match to their correct definitions terms associated with miscellaneous equipment.
2. Identify miscellaneous equipment used by carpenters.
3. Identify the parts of a prefabricated rolling scaffold.
4. Identify equipment used for specific construction jobs.
5. State safety precautions pertaining to miscellaneous equipment.
6. Distinguish among hand signals used in rigging and maneuvering operations.
7. Demonstrate the ability to
    a. Set up a section of scaffolding.
    b. Dress a grinding wheel.
    c. Use a bench grinder to dress and sharpen tools.

MISCELLANEOUS EQUIPMENT
UNIT III

SUGGESTED ACTIVITIES

I. Unit contents

  A. Objective sheet

  B. Suggested activities

    1. Supplement #1 — Miscellaneous Equipment Crossword Puzzle

    2. Transparency masters

      a. TM #1 — Ladder Safety

      b. TM #2 — Ladder Danger

  C. Information sheet

  D. Assignment Sheet #1 — Distinguish Among Hand Signals Used in Rigging and Maneuvering Operations

  E. Answers to assignment sheet

  F. Job sheets

    1. Job Sheet #1 — Set Up a Section of Scaffolding

    2. Job Sheet #2 — Dress a Grinding Wheel

    3. Job Sheet #3 — Use a Bench Grinder to Dress and Sharpen Tools

  G. Test

  H. Answers to test

II. Instructor's guide

  A. Obtain materials to supplement unit.

    1. Films

    2. Books

    3. Transparencies and competency profiles

    (NOTE: Transparencies and competency profiles for this book are available from the Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074 or from The Associated General Contractors of America, 1957 E Street N.W., Washington, D.C. 20006; phone 202-393-2040.)

SUGGESTED ACTIVITIES

4. Equipment and materials for job sheet procedures

B. Make transparencies and additional copies of assignment sheet or supplement if needed.

C. Provide students with objective sheet.

D. Discuss unit and specific objectives.

SUGGESTIONS:

- Emphasize the importance of identifying the many kinds of miscellaneous equipment. Stress that although this equipment is usually furnished by the employer or contractor, these tools of the trade will be used as long as the student is a carpenter.
- Point out the importance of observing proper safety precautions when handling miscellaneous equipment.

E. Provide students with information, assignment, and job sheets.

F. Discuss information, assignment, and job sheets.

1. Use Information Sheet, Section I to discuss terms associated with miscellaneous equipment.

   SUGGESTIONS:

   - Point out the importance of defining terms for common understanding.
   - Have students review terms by completing Supplement #1, "Miscellaneous Equipment Crossword Puzzle."

2. Use Information Sheet, Section II to discuss miscellaneous equipment used by carpenters.

   SUGGESTIONS:

   - Make a set of flash cards containing pictures of miscellaneous equipment. Show students flash cards and have them identify the picture and write their answer on a sheet of paper.
   - Plan a field trip to the site of a large construction job to see how some of the equipment shown in this unit is being used.
   - Have students identify miscellaneous equipment in the shop or work area and tell how it may be used.

SUGGESTED ACTIVITIES

3. Use Information Sheet, Section III, and Job Sheet #1 to discuss setting up a scaffold.

   SUGGESTIONS:

   - Lay out the parts of an actual prefabricated rolling scaffold and have students identify the parts.
   - Demonstrate the procedure outlined in Job Sheet #1.
   - Have students complete Job Sheet #1 by setting up a section of a scaffold. This could be done on an individual or team-of-two basis.

4. Use Information Sheet, Sections IV and V to discuss miscellaneous equipment used for specific jobs, and the safety rules related to such equipment.

   SUGGESTIONS:

   - Have students take pictures or cut pictures out of magazines and newspapers illustrating such equipment being used on the job.
   - Have students survey the community to determine where such equipment is being used.
   - Show a film on safety.
   - Use Transparencies #1 and #2 to emphasize ladder safety.
   - Have students demonstrate correct safety precautions to the class.
   - Have students brainstorm and add more safety precautions to those listed in Section V.
   - Demonstrate procedures outlined in Job Sheets #2 and #3.
   - Have students complete Job Sheets #2 and #3.

5. Use Information Sheet, Section VI, and Assignment Sheet #1 to discuss hand signals used in rigging operations.

   SUGGESTIONS:

   - Have students complete Assignment Sheet #1; critique and discuss in class.
   - Have students pair off and practice giving and receiving hand signals. You might take students outside and space far enough apart so that they cannot talk to each other when practicing hand signals.
   - Have students practice hand signals in a simulated job situation.

G. Give test.

SUGGESTED ACTIVITIES

H. Critique test and discuss in class.

I. Reteach if necessary.

J. Complete appropriate section of competency profiles.

III. Unit references

A. *Bosch Power Tools.* New Bern, North Carolina: Robert Bosch Power Tool Corporation, 1982.

B. *Goldblatt Tool Catalog.* Kansas City, Kansas: Goldblatt Tool Company, 1983.

C. Hendrix, Laborn J., "Bud." *Bricklaying Curriculum.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and The Associated General Contractors of America, 1984.

D. Hendrix, Laborn J., "Bud." *Commercial Carpentry.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and The Associated General Contractors of America, 1979.

E. Hendrix, Laborn J., "Bud." *Heavy Equipment Operator Basic Core.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and The Associated General Contractors of America, 1981.

F. Hendrix, Laborn J., "Bud." *Heavy Equipment Operator: General Equipment.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and The Associated General Contractors of America, 1982.

G. *Industrial Products Catalog, GT/RY.* Chicago, Illinois: Sears, Roebuck and Company, 1978/1979.

H. Jacobs, Clinton O., and Howard J. Turner. *Developing Shop Safety Skills.* Athens, Georgia: American Association for Vocational Instructional Materials, 1981.

I. *Milwaukee Electric Tool Catalog 479.* Brookfield, Wisconsin: Milwaukee Electric Tool Corporation, a subsidiary of Amstar Corporation, n.d.

J. *Power and Hand Tools Specialog.* Chicago, Illinois: Sears, Roebuck and Company, 1983/1984.

K. *Skil Power Tool Catalog.* Chicago, Illinois: Skil Corporation, Subsidiary of Emerson Electric Company, n.d.

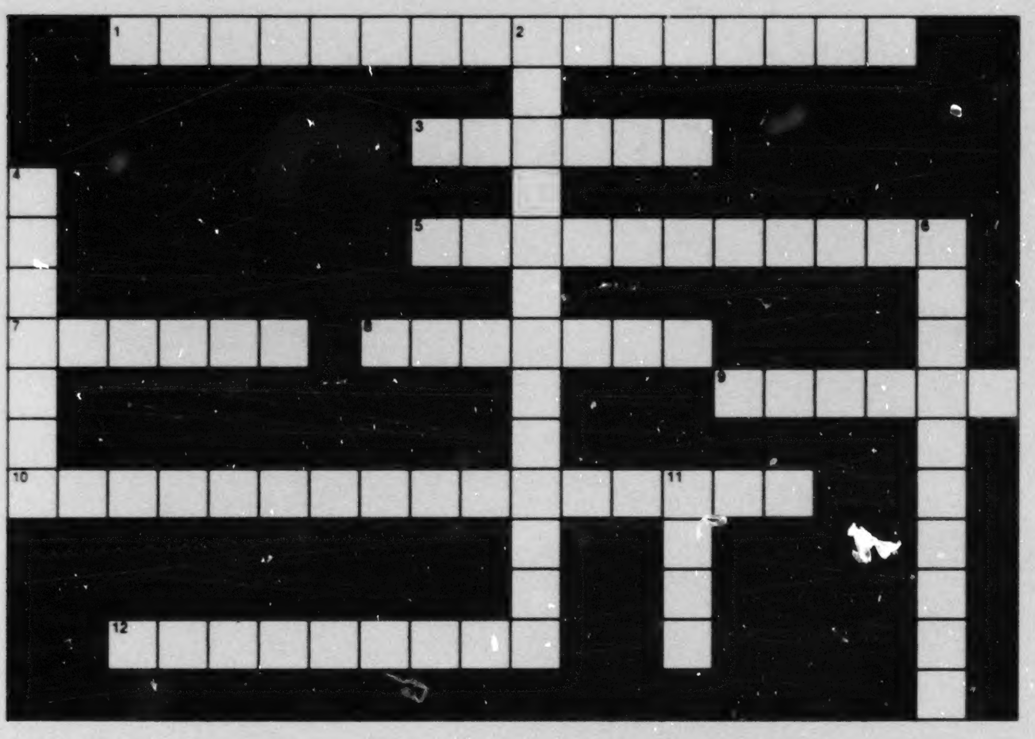
L. *Tools and Equipment Catalog.* Gibsonia, Pennsylvania: Masonry Speciality Company, 1983.

M. Wagner, Willis H. *Modern Carpentry.* South Holland, Illinois: The Goodheart-Willcox Co., Inc., 1976.

SUGGESTED ACTIVITIES

SUPPLEMENT #1 — MISCELLANEOUS EQUIPMENT CROSSWORD PUZZLE

Review terms and definitions associated with miscellaneous equipment by completing the crossword puzzle below. Solution is on the following page.



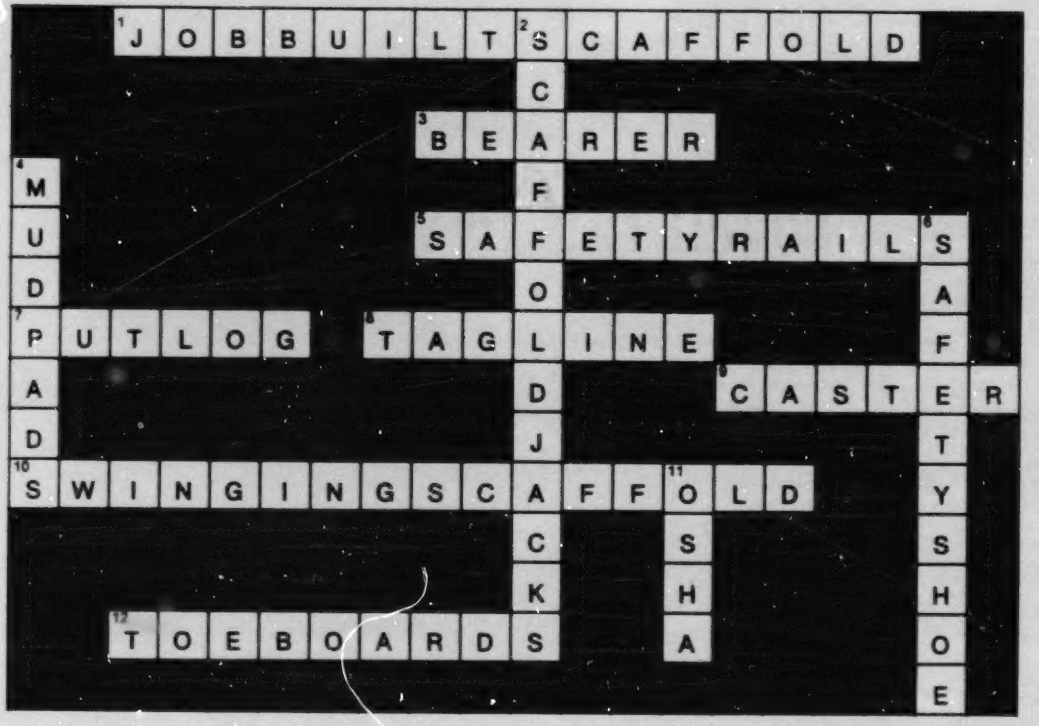
ACROSS

1. Scaffold that is constructed and set up on the site where it is to be used (2 wds.)
3. Any small member used primarly to support another member or structure
5. Guardrails attached on scaffolds about 42 inches high and midway between 42 inches and toe board (2 wds.)
7. Short member on which the scaffold planks or platform is laid and attached
8. Rope used to guide or steady a load being hoisted
9. Wheel used to support scaffold; mounted in a swivel frame and usually furnished with brakes
10. Type of scaffold normally hung from top of a structure for which it is not practical to build a scaffold (2 wds.)
12. Four-inch guardrails attached ¼ inch above scaffold platform to prevent tools and materials from falling from scaffold

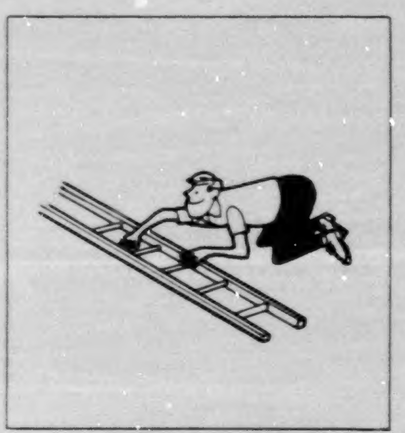
DOWN

2. Angle-shaped devices manufactured to fasten on forms in pairs to support a platform for workers and materials (2 wds.)
4. Heavy pieces of wood nailed together to form pads about 18 inches square; used on ground to support scaffolds
6. Safety device on bottom of ladders; used to prevent ladder heel from sliding (2 wds.)
11. Federal legislation designed to ensure safe and sanitary working conditions for employees (abbr.)

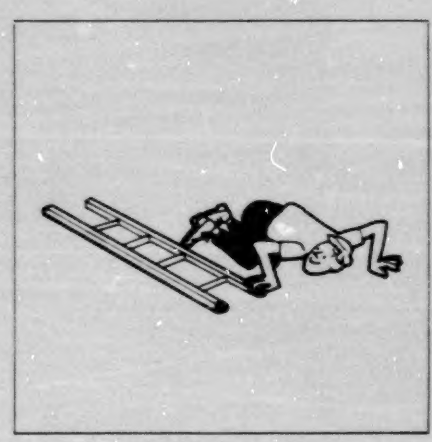
SOLUTION TO SUPPLEMENT #1


1 JOBBUILTSCAFFOLD
2 SCAFFOLDJACKS
3 BEARER
4 MUDPAD
5 SAFETYRAILS
6 SAFETYSHOE
7 PUTLOG
8 TAGLINE
9 CASTER
10 SWINGINGSCAFFOLD
11 OSHA
12 TOEBOARDS

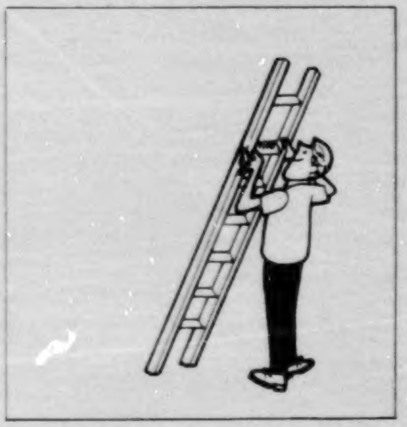
Ladder Safety



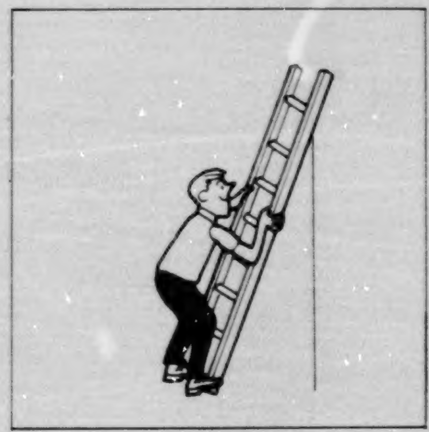
Check Condition



Check Safety Shoes



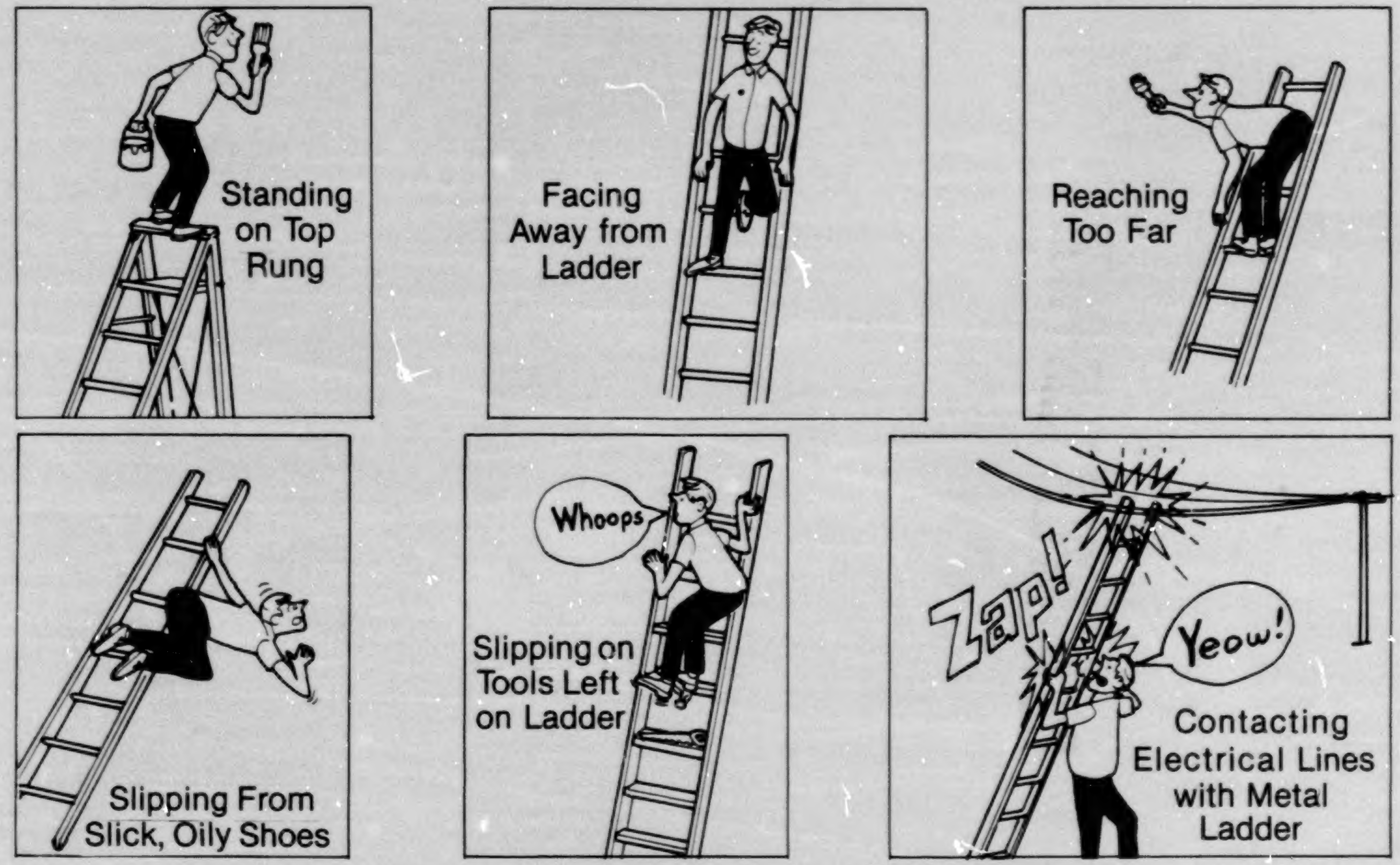
Check Load Limit



Place at Comfortable Stance

Adapted with permission of American Association for Vocational Instructional Materials, Athens, Georgia, from *Developing Shop Safety Skills* by Clinton O. Jacobs and J. Howard Turner, 1981.

Ladder Danger


Standing on Top Rung
Facing Away from Ladder
Reaching Too Far
Slipping From Slick, Oily Shoes
Whoops
Slipping on Tools Left on Ladder
Zap!
Yeow!
Contacting Electrical Lines with Metal Ladder

Adapted with permission of American Association for Vocational Instructional Materials, Athens, Georgia, from *Developing Shop Safety Skills* by Clinton O. Jacobs and J. Howard Turner, 1981.

TM #2

FC - 219-C

MISCELLANEOUS EQUIPMENT
UNIT III

INFORMATION SHEET

I. Terms and definitions

A. Bearer — Any small member used primarily to support another member or structure

B. Caster — Wheel used to support scaffold; mounted in a swivel frame and usually furnished with brakes

C. Job-built scaffold — Scaffold that is constructed and set up on the site where it is to be used

D. Mudpads — Heavy pieces of wood nailed together to form pads about 18 inches square; used on ground to support scaffolds

E. OSHA (Occupational Safety and Health Act) — Federal legislation designed to ensure safe and sanitary working conditions for employees

F. Putlog — Short member on which the scaffold planks or platform is laid and attached

G. Safety shoe — Safety device on bottom of ladders; used to prevent ladder heel from sliding

H. Safety rails — Guardrails attached on scaffolds about 42 inches high and midway between 42 inches and toeboard

I. Scaffold jacks — Angle-shaped devices manufactured to fasten on forms in pairs to support a platform for workers and material

J. Swinging scaffold (stage) — Type of scaffold normally hung from top of a structure for which it is not practical to build a scaffold

K. Tagline — Rope used to guide or steady a load being hoisted

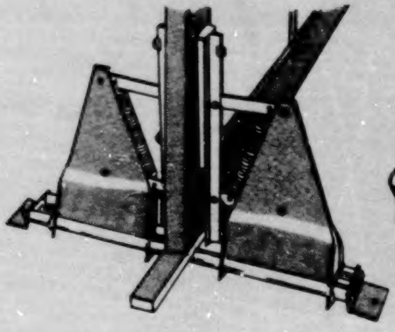
L. Toeboards — Four-inch guardrails attached ¼ inch above scaffold platform to prevent tools and materials from falling from scaffold

INFORMATION SHEET

II. Miscellaneous equipment used by carpenters (Figures 1-36)

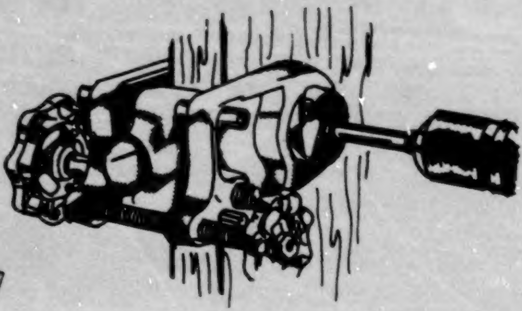
A. Door jack (door holder)

FIGURE 1



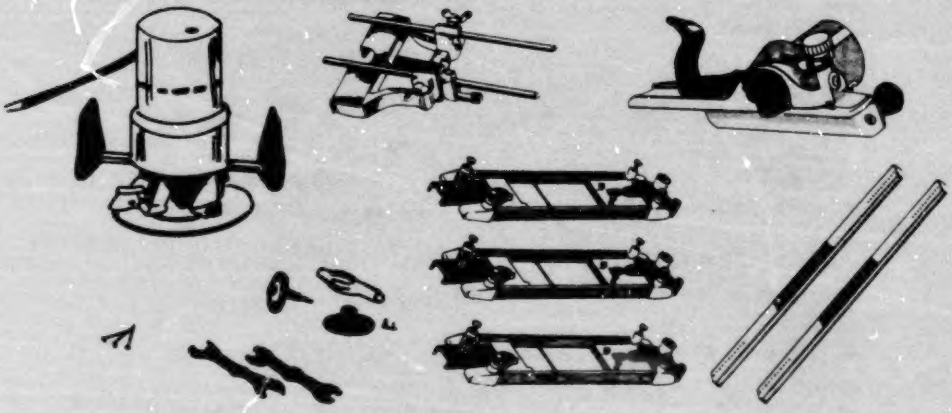
B. Lock installation boring jig

FIGURE 2



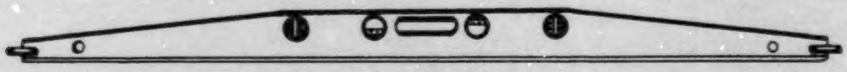
C. Door-hanging kit

FIGURE 3



D. Door jamb level

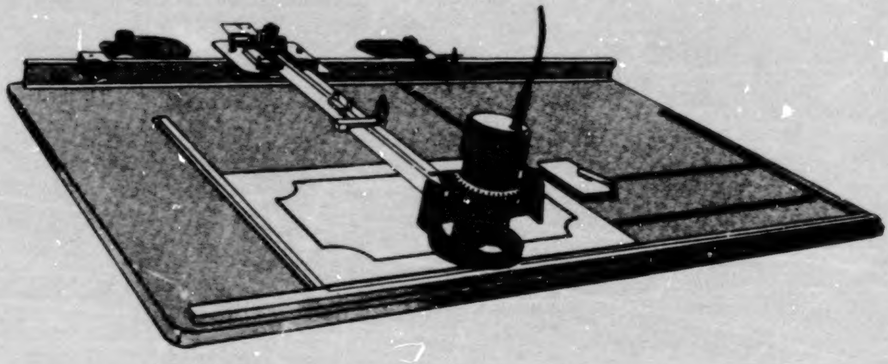
FIGURE 4



INFORMATION SHEET

E. Cabinet door routing template

FIGURE 5



F. Air compressors

1. Gasoline

2. Electric

FIGURE 6

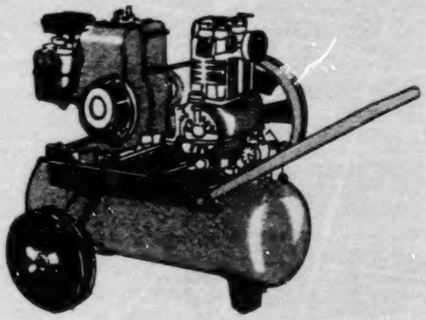
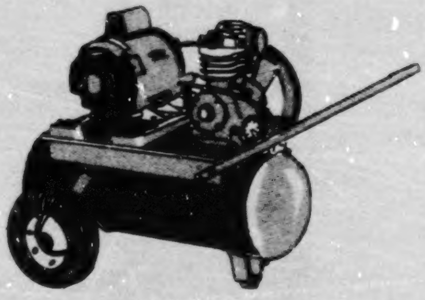


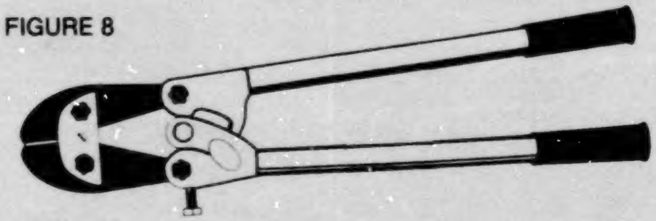
FIGURE 7



INFORMATION SHEET

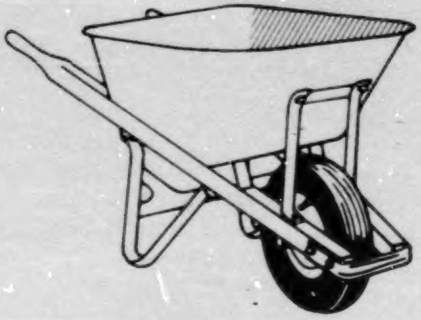
G. Bolt cutters

FIGURE 8



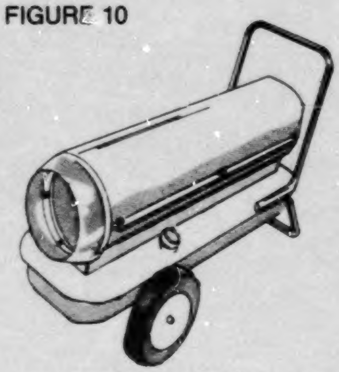
H. Wheelbarrow

FIGURE 9



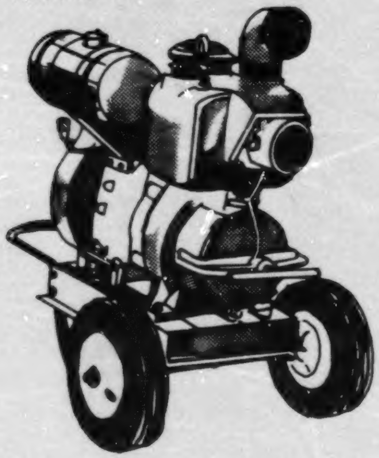
I. Space heater

FIGURE 10



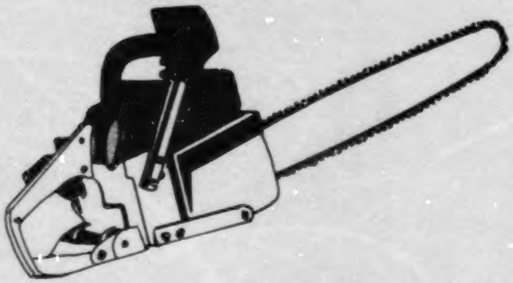
J. Centrifugal water pump

FIGURE 11



K. Chain saw

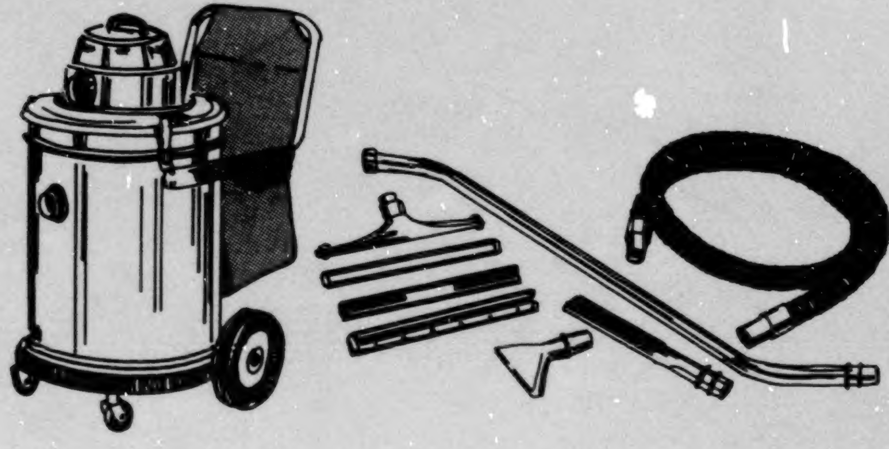
FIGURE 12



INFORMATION SHEET

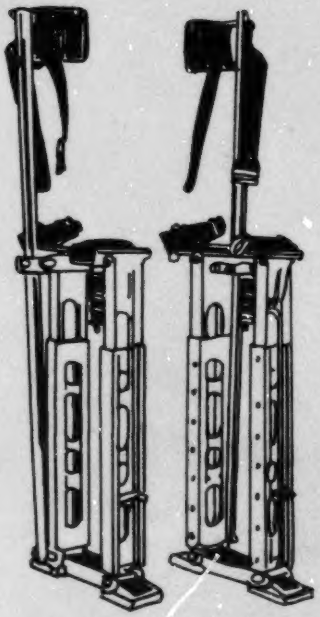
L. Vacuum cleaner and accessories

FIGURE 13



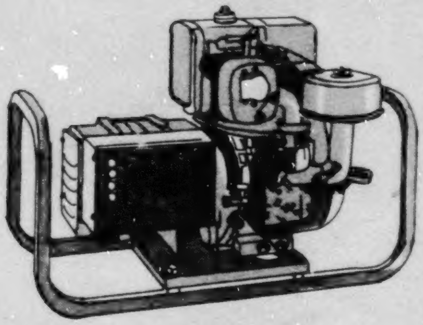
M. Stilts

FIGURE 14



N. Alternator

FIGURE 15

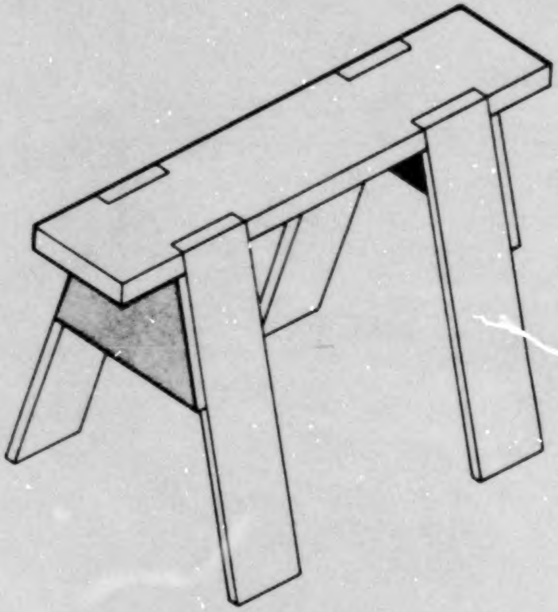


Used with permission of Goldblatt Tool Company, Kansas City, Kansas.

INFORMATION SHEET

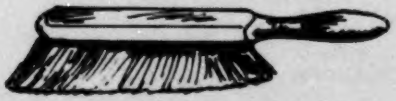
O. Sawbuck (sawhorse)

FIGURE 16



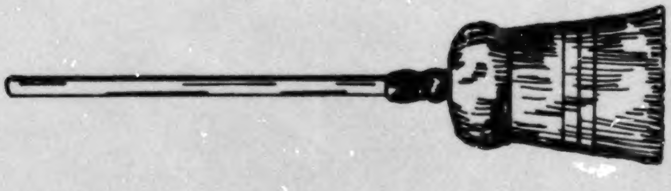
P. Bench brush

FIGURE 17



Q. Hand broom

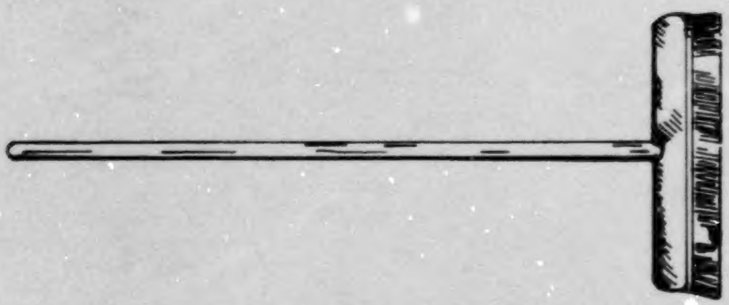
FIGURE 18



INFORMATION SHEET

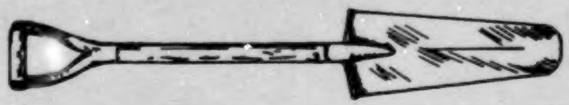
R. Push broom

FIGURE 19



S. Spade (sharpshooter)

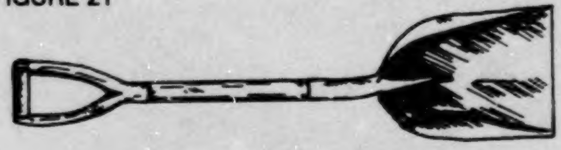
FIGURE 20



T. Shovels

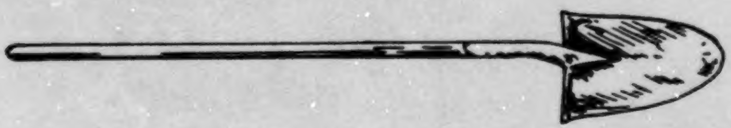
1. Scoop

FIGURE 21



2. Long-handled, round-point

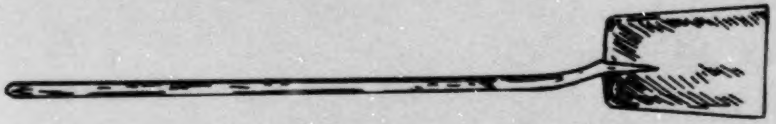
FIGURE 22



INFORMATION SHEET

3. Long-handled, square-point

FIGURE 23



U. Ladders

(NOTE: Ladders may be wood, metal, or fiberglass. Maintain caution when using metal ladders near any electrical wires or equipment.)

1. Stepladder
2. Extension
3. Single, straight

FIGURE 24

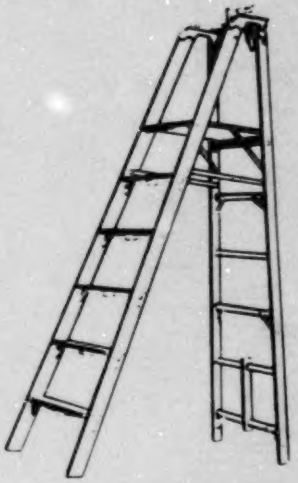


FIGURE 25

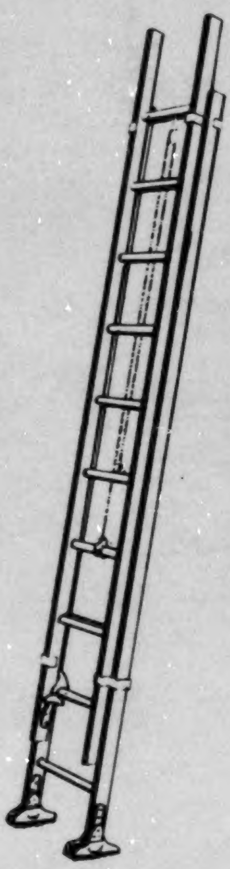
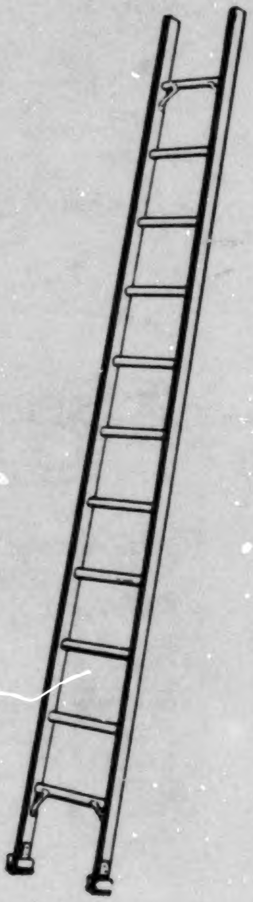


FIGURE 26



INFORMATION SHEET

V. Scaffolds

(NOTE: Scaffolds may be wood, steel, or aluminum; they may be prefabricated or built at the job site.)

1. Prefabricated

FIGURE 27

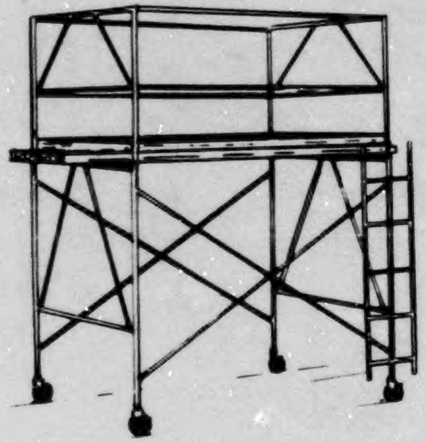


FIGURE 28

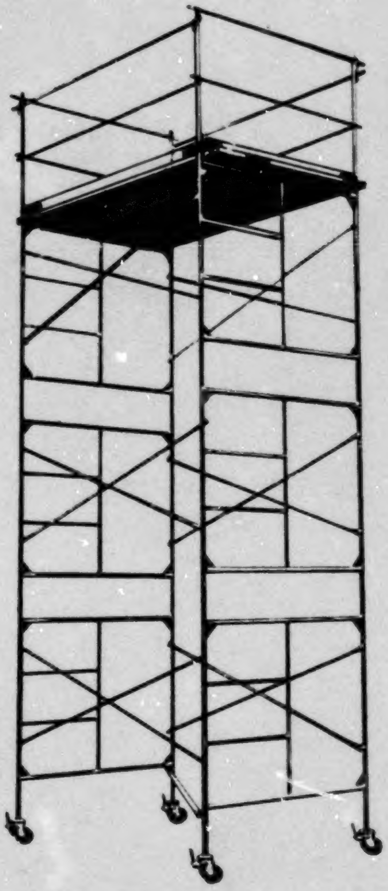
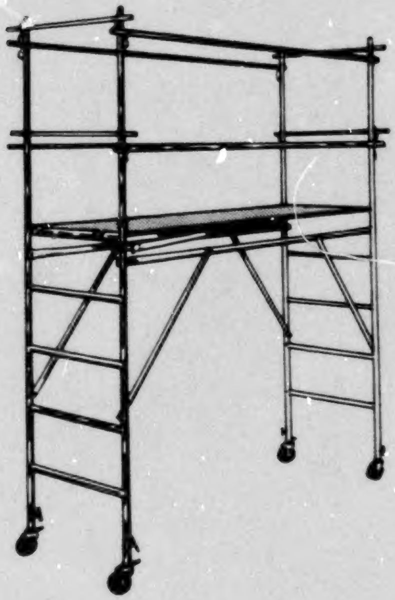


FIGURE 29



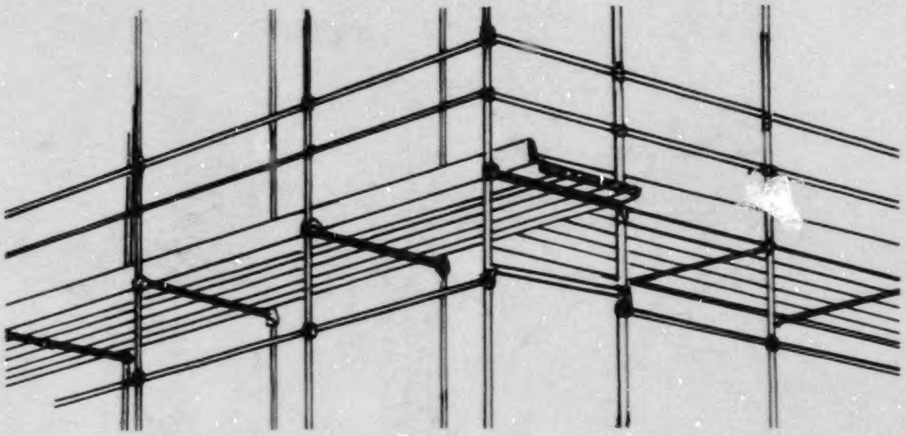
Figures 28 and 29 used with permission of Deal Products, Easton, Pennsylvania.

INFORMATION SHEET

2. Tubular locking

(NOTE: This type of scaffolding can be used with curved or irregular shapes such as cylinders, spheres, and pyramids.)

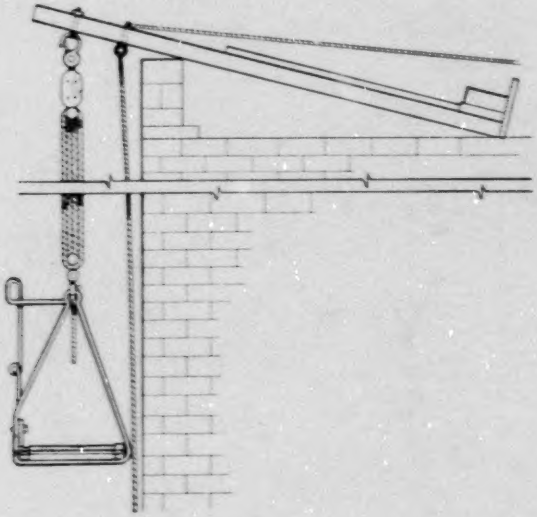
FIGURE 30



Used with permission of Patent Scaffolding Company, Fort Lee, New Jersey.

3. Swinging

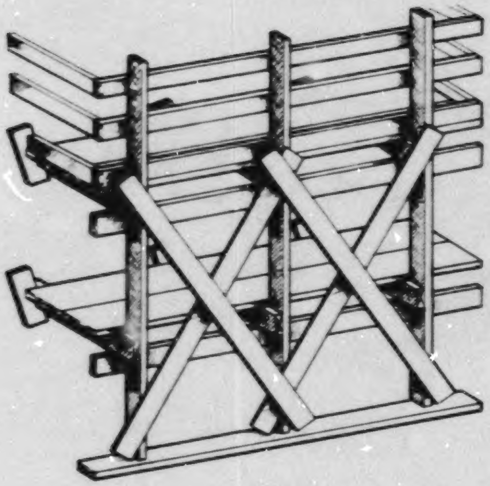
FIGURE 31



INFORMATION SHEET

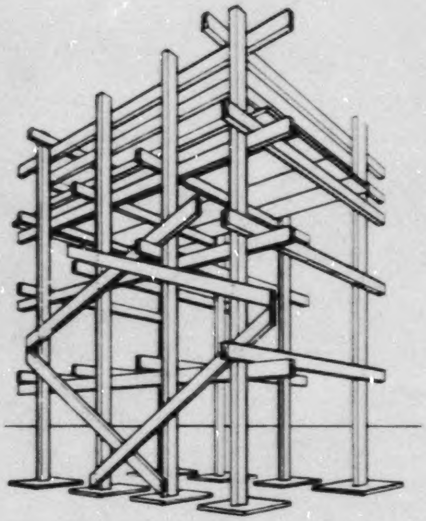
4. Single-pole

FIGURE 32



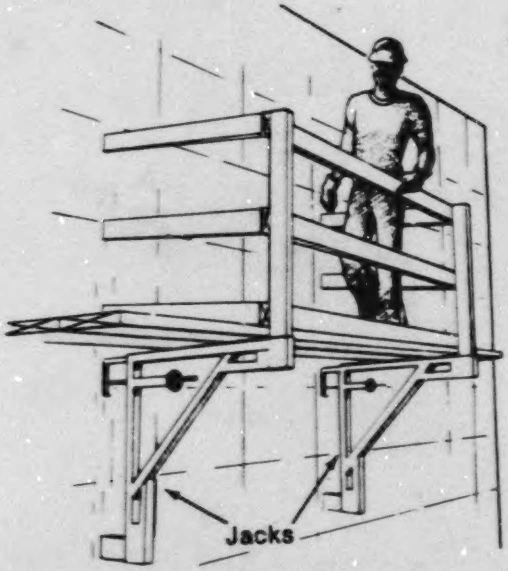
5. Double-pole

FIGURE 33



6. Scaffold jacks with platform

FIGURE 34

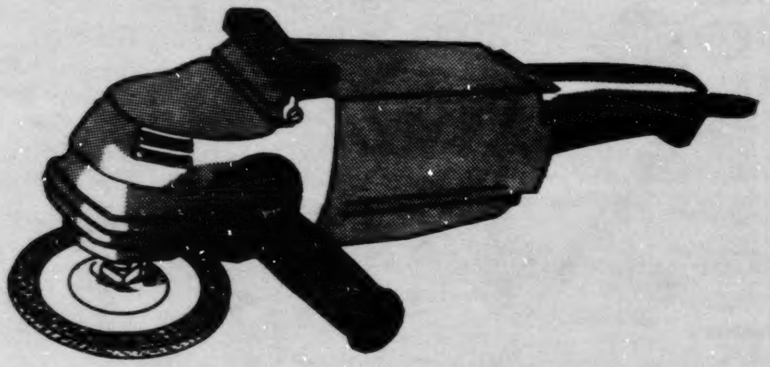


INFORMATION SHEET

W. Grinders

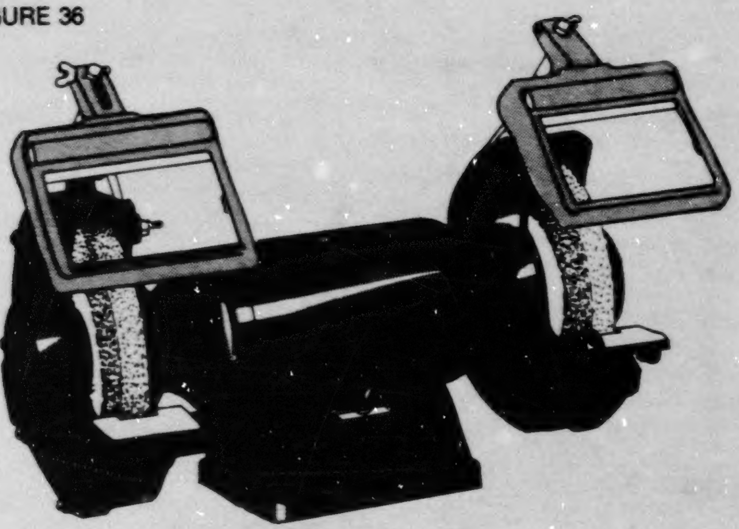
1. Angle

FIGURE 35



2. Bench

FIGURE 36

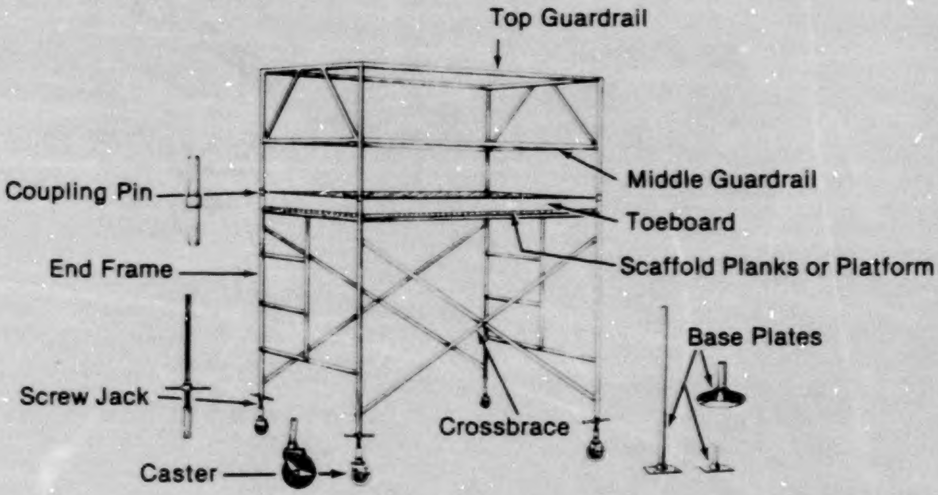


INFORMATION SHEET

III. Parts of a prefabricated rolling scaffold (Figure 37)

(NOTE: OSHA requires a top guardrail approximately 42 inches high, a midrail halfway between top guardrail and toeboard, and a toeboard just above the scaffold plank or platform.)

FIGURE 37

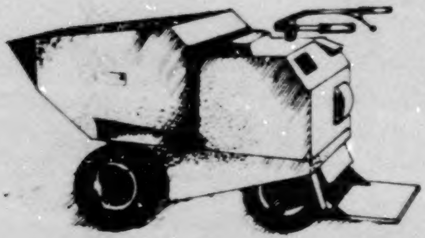

Top Guardrail
Coupling Pin
Middle Guardrail
Toeboard
End Frame
Scaffold Planks or Platform
Base Plates
Screw Jack
Crossbrace
Caster

INFORMATION SHEET

IV. Equipment for specific construction jobs (Figures 38-43)

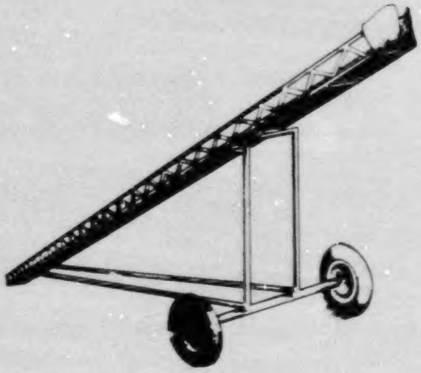
A. Power buggy

FIGURE 38



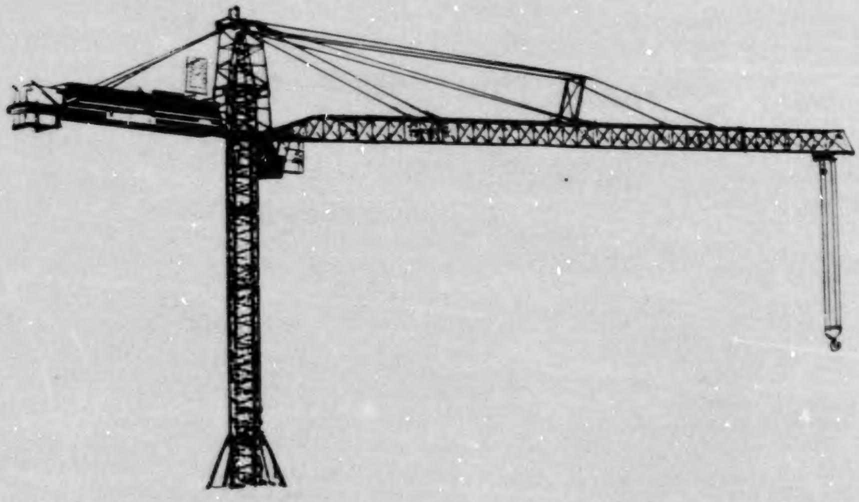
B. Conveyor

FIGURE 39



C. Tower crane

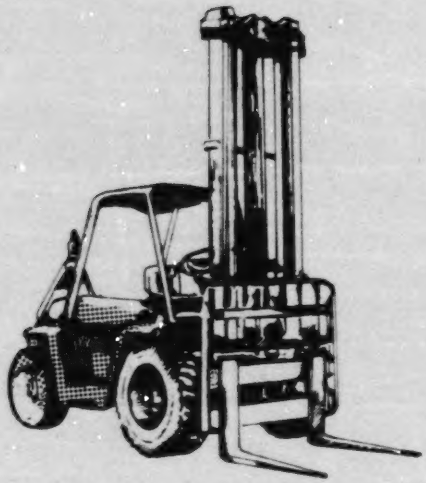
FIGURE 40



INFORMATION SHEET

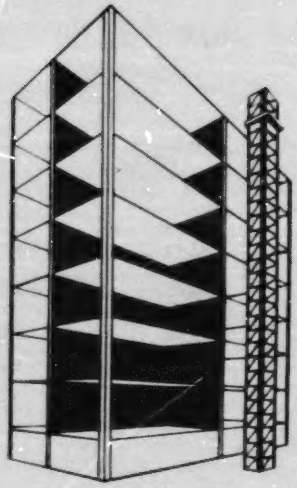
D. Forklift

FIGURE 41



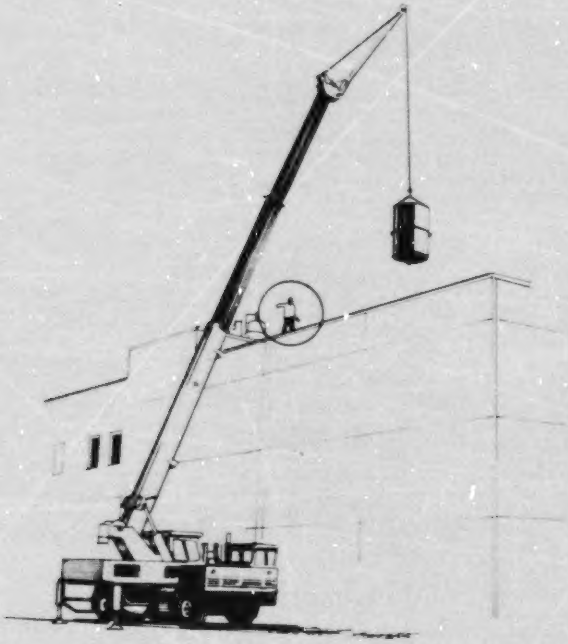
E. Hoist

FIGURE 42



F. Mobile crane

FIGURE 43



Used with permission of the Construction Safety Association of Ontario, from the *Crane Handbook*, compiled by D.E. Dickie, 1975.

INFORMATION SHEET

V. Safety precautions for miscellaneous equipment

  A. General

    1. Do not remove safety devices from equipment
    2. Do not use heaters or gasoline-powered equipment in an unventilated area
    3. Check condition of all equipment before using; always mark damaged equipment and report it to your instructor or supervisor

  B. Scaffolding and rigging

    1. Always check for electrical wires and deenergize before erecting metal scaffolding in the vicinity
    2. Be sure that wheels are locked on rolling scaffolds before ascending
    3. Do not work on scaffolds during storms, high winds, or when scaffolds are covered with ice or snow
    4. Tie off scaffolds about every 25 feet when they are built several sections high
    5. Do not overload scaffolds
    6. Be sure that scaffolds are equipped with top rail (42 inches high), midrail, and toeboard
    7. Use safety belts, harness, and nets as required
    8. Check safe working load of all rigging used
    9. Exercise extreme caution when moving cranes and other hoisting equipment

  C. Ladders

    1. Fully spread and lock any stepladder before using
    2. Do not use ladders that are not equipped with safety shoes
    3. Never overreach from a ladder
    4. Never work from the top step of any ladder
    5. Never use a metal ladder when there is any possibility of contact with electrical conductors

INFORMATION SHEET

6. Never use ladders in a horizontal position

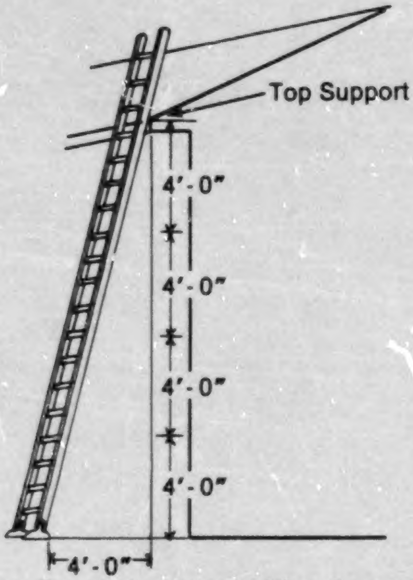
7. Do not climb on a ladder that is occupied by someone else

8. Remove ladder when you are finished using it, and always remove and store ladder at end of workday

9. Place ladders approximately one-quarter of their support length away from vertical plane of top support, and extend ladders at least 3 feet above top support (Figures 44 and 45)

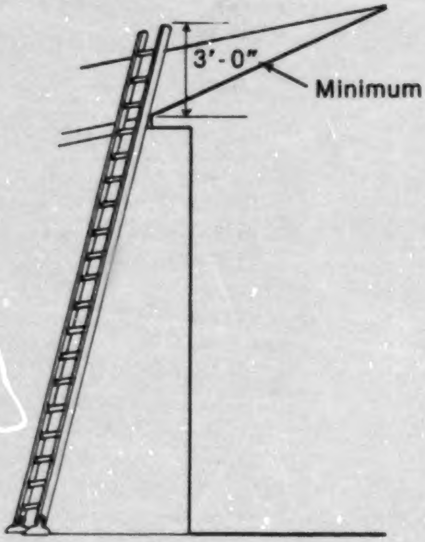
EXAMPLES:

FIGURE 44



One-Fourth the Height of Top Support

FIGURE 45



10. Secure ladders at both top and bottom to prevent displacement; brace long ladders at intermediate points to prevent spring

D. Grinders

1. Be sure to use proper type and size grinding wheel for job being done

2. Always operate grinder at recommended speed

3. Be sure that grinding wheel is properly mounted on spindle

4. Never stand in front of grinder when starting

5. Always wear safety goggles when operating grinder

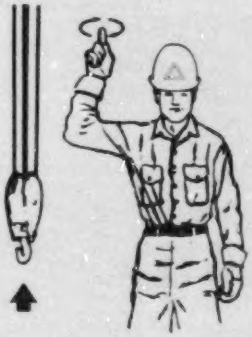
INFORMATION SHEET

VI. Hand signals used in rigging and maneuvering operations

A. Operating boom (Figures 46-61)

1. Hoist load

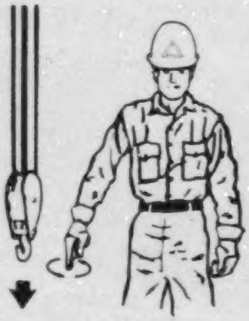
FIGURE 46



Forearm vertical, forefinger pointing up, move hand in small horizontal circles.

2. Lower load

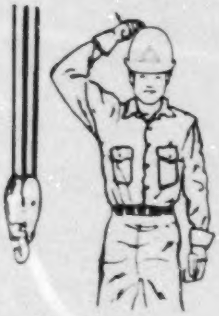
FIGURE 47



Arm extended downward, forefinger pointing down, move hand in small horizontal circles.

3. Use main hoist

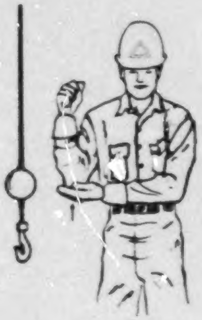
FIGURE 48



Tap fist on head; then use regular signals.

4. Use whipline

FIGURE 49

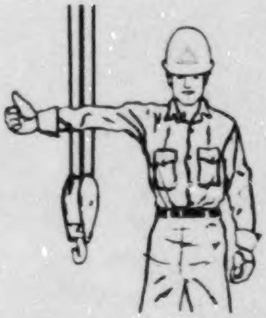


Tap elbow with one hand; then use regular signals.

INFORMATION SHEET

5. Raise boom

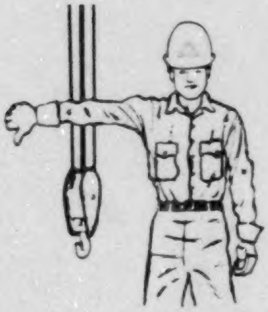
FIGURE 50



Extend arm, fingers closed, thumb pointing up.

6. Lower boom

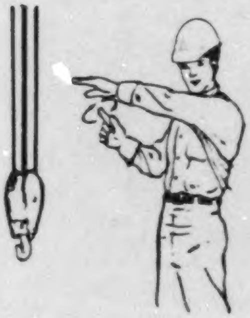
FIGURE 51



Extend arm, fingers closed, thumb pointing down.

7. Move slowly

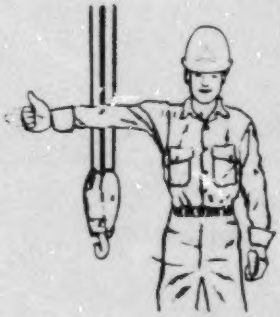
FIGURE 52



Use one hand to give any motion signal, and place other hand motionless in front of hand giving motion signal. (*Hoist slowly* is shown in example.)

8. Raise boom and lower load

FIGURE 53

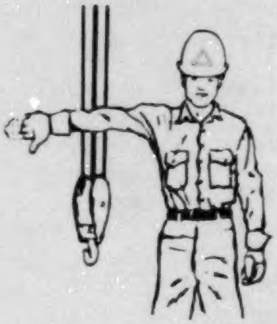


Arm extended, thumb pointing up, flex fingers in and out as long as load movement is desired.

INFORMATION SHEET

9. Lower boom and raise load

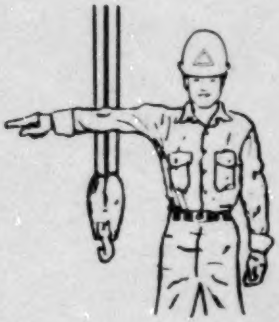
FIGURE 54



Arm extended, thumb pointing down; flex fingers in and out as long as load movement is desired.

10. Swing

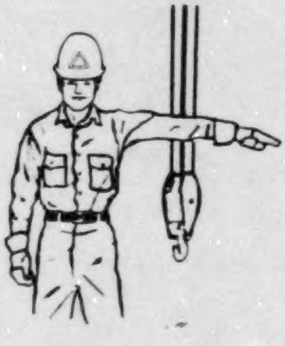
FIGURE 55



Arm extended, point with finger in direction of swing of boom.

11. Stop

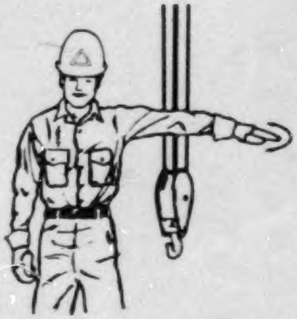
FIGURE 56



Arm extended, palm down, hold position rigidly.

12. Emergency stop

FIGURE 57

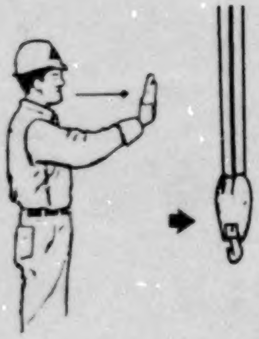


Arm extended, palm down, move hand rapidly right and left.

INFORMATION SHEET

13. Travel

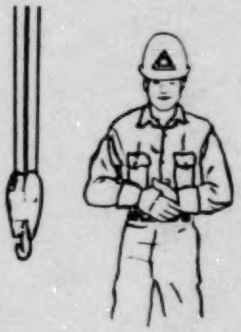
FIGURE 58



Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.

14. Dog everything

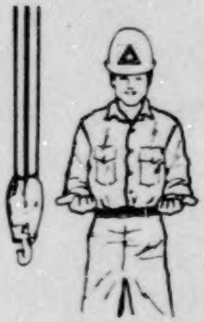
FIGURE 59



Clasp hands in front of body.

15. Extend boom

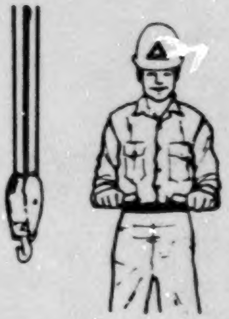
FIGURE 60



Hold both fists in front of body with thumbs pointing outward.

16. Retract boom

FIGURE 61



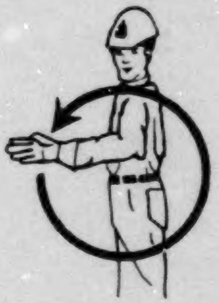
Hold both fists in front of body with thumbs pointing toward each other.

INFORMATION SHEET

B. Maneuvering vehicles (Figures 62-66)

1. Move

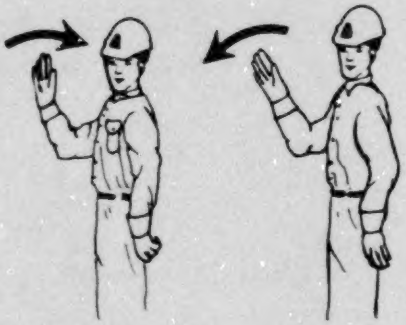
FIGURE 62



Extend forearm forward and rotate in direction of motion.

2. Move backward or forward

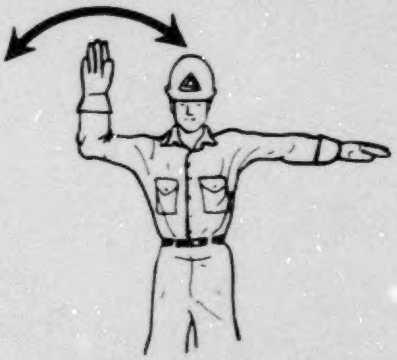
FIGURE 63



Extend arm forward, forearm vertical, hand open, palm forward; move arm in direction of motion.

3. Turn while moving

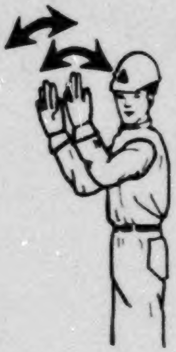
FIGURE 64



One forearm vertical, palm facing forward, move arm back and forth to indicate movement; other arm extended, palm down, point in direction of turn.

4. Straighten out

FIGURE 65

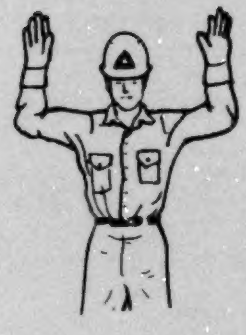


Both arms extended forward, forearms vertical, hands open, one palm facing out and the other facing in; move forearms forward and back.

INFORMATION SHEET

5. Stop

FIGURE 66



Hold both arms to the side, forearms vertical, hands open, palms facing out.

MISCELLANEOUS EQUIPMENT
UNIT III

ASSIGNMENT SHEET #1 — DISTINGUISH AMONG HAND SIGNALS USED IN RIGGING AND MANEUVERING OPERATIONS

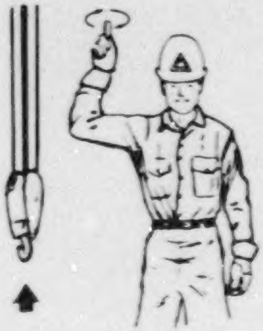
NAME ______________________________ SCORE ______________

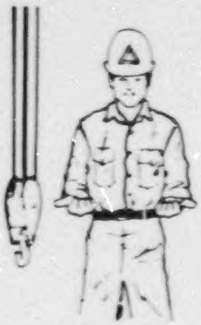
For construction operations in which rigging equipment is used, it is very important to know how to use hand signals. Knowing how to use hand signals may enable you to help another worker avoid a dangerous situation and may also prevent a serious accident.

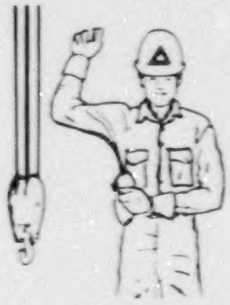
PART I

Distinguish among the following hand signals for operating a boom and maneuvering vehicles by writing an "X" in the blank under each correct illustration.

A. Hoist load

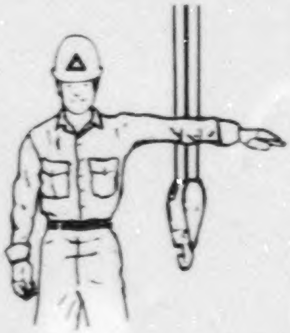


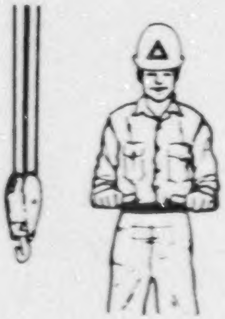


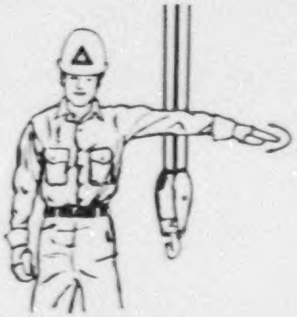


1. ______________ 2. ______________ 3. ______________

B. Emergency stop



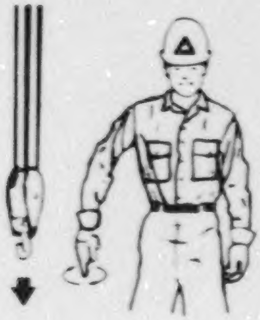




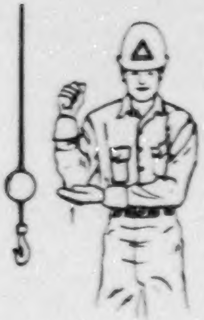
1. ______________ 2. ______________ 3. ______________

ASSIGNMENT SHEET #1

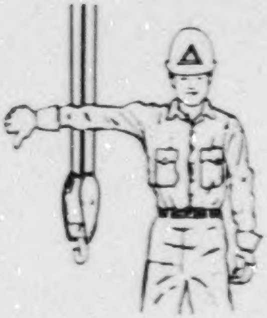
C. Lower boom



1. ____________________

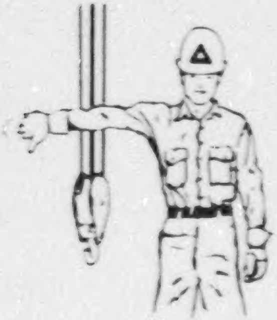


2. ____________________

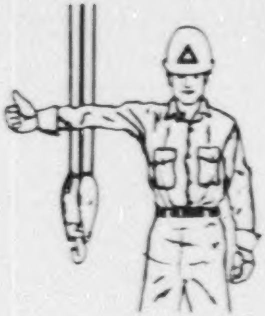


3. ____________________

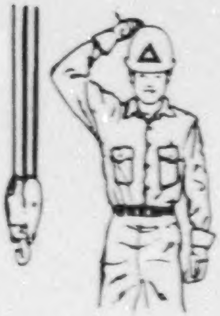
D. Lower boom and raise load



1. ____________________



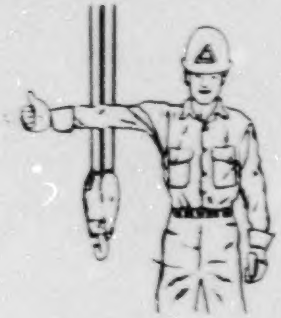
2. ____________________



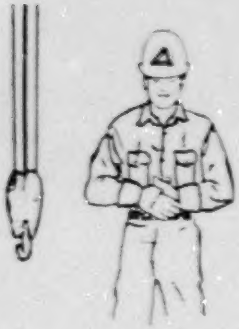
3. ____________________

ASSIGNMENT SHEET #1

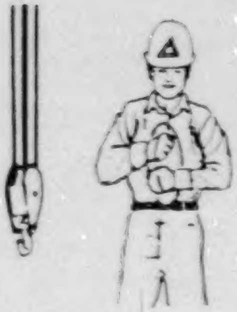
E. Dog everything



1. ____________________

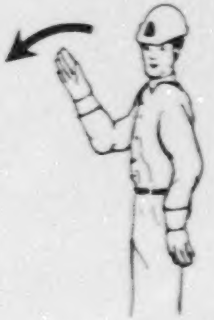


2. ____________________

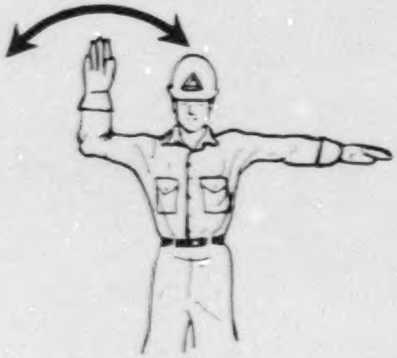


3. ____________________

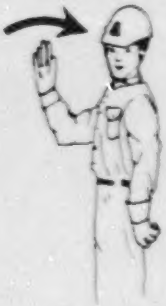
F. Turn while moving



1. ____________________



2. ____________________



3. ____________________

ASSIGNMENT SHEET #1

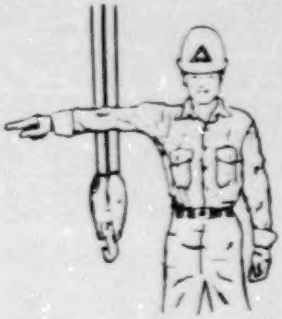
PART II

Distinguish among the following hand signals by writing an "X" in each correct blank.

A. _____ 1. Turn while moving

_____ 2. Swing

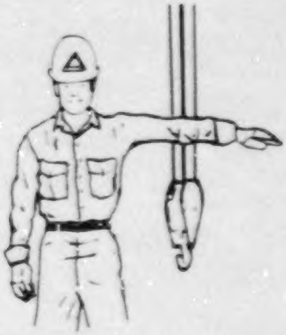
_____ 3. Move in this direction



B. _____ 1. Move in this direction

_____ 2. Stop

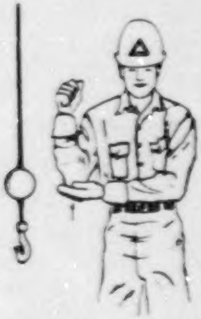
_____ 3. Raise boom



C. _____ 1. Emergency stop

_____ 2. Rehaul or retract

_____ 3. Use whipline

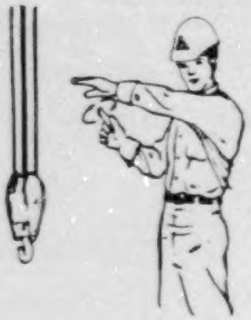


ASSIGNMENT SHEET #1

D. _____ 1. Lower boom and hold load

_____ 2. Lower boom and raise load

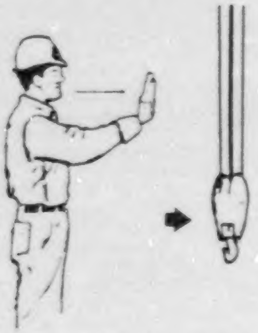
_____ 3. Move slowly



E. _____ 1. Lower load

_____ 2. Lower boom

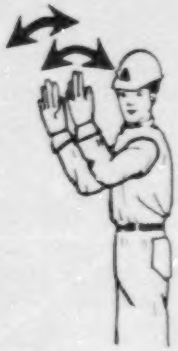
_____ 3. Travel



F. _____ 1. Stop

_____ 2. Straighten out

_____ 3. Turn while moving



FC - 251-C

MISCELLANEOUS EQUIPMENT
UNIT III

ANSWERS TO ASSIGNMENT SHEET

Assignment Sheet #1

Part I

A. 1
B. 3
C. 3
D. 1
E. 2
F. 2

Part II

A. 2
B. 2
C. 3
D. 3
E. 3
F. 2

MISCELLANEOUS EQUIPMENT
UNIT III

JOB SHEET #1 — SET UP A SECTION OF SCAFFOLDING

I. Equipment

  A. Two end frames

  B. Two safety rail end frames

  C. Two crossbraces

  D. Two scaffold planks

  (NOTE: Be sure that planks have safety cleats.)

  E. Four guardrails

  F. Four toeboards

  G. Four coupling pins

  H. Four casters

  I. Ladder section

II. Procedure

  A. Secure crossbraces to one end frame

  B. Secure crossbraces to second end frame

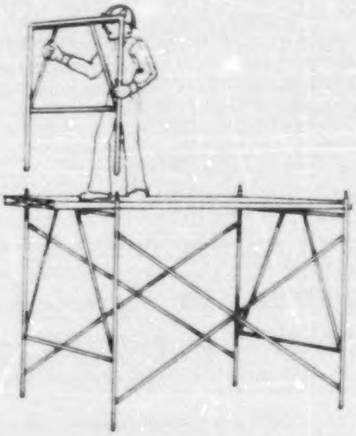
  C. Set scaffold planks on end frames, safety cleats facing down

  D. Set coupling pins in both end frames

  E. Lift safety rail end frames to scaffold planks

  F. Climb to scaffold planks, and set one safety rail end frame over coupling pins (Figure 67)

FIGURE 67



JOB SHEET #1

G. Set second end frame over remaining coupling pins

H. Secure toeboards to uprights

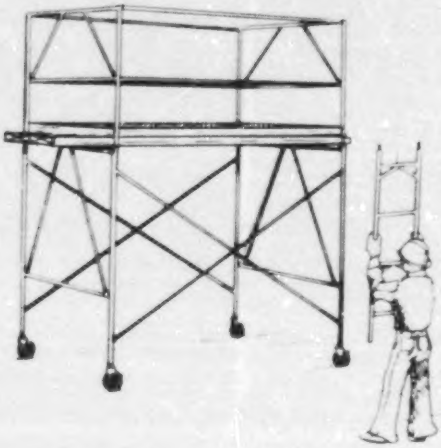
I. Secure guardrails

J. Lift one end of scaffold and insert casters; set brakes

K. Lift opposite end of scaffold and insert casters; set brakes

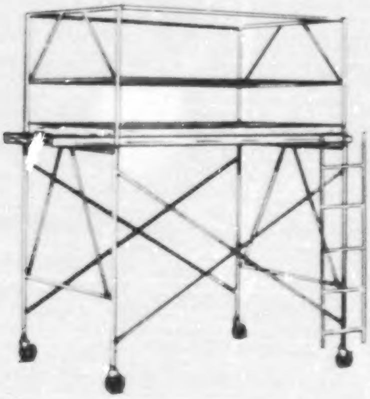
L. Attach ladder section (Figure 68)

FIGURE 68



M. Inspect completed scaffold (Figure 69)

FIGURE 69



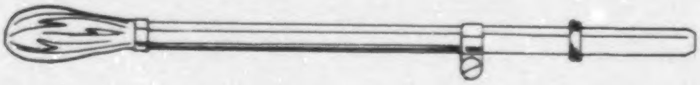
MISCELLANEOUS EQUIPMENT
UNIT III

JOB SHEET #2 — DRESS A GRINDING WHEEL

I. Tools and equipment

- A. Bench grinder
- B. Wheel dressing tool (Figure 70)

FIGURE 70



- C. Goggles or full face shield

II. Procedure

CAUTION

Always operate grinder effectively, efficiently, and safely as outlined in grinder safety rules.

- A. Put on goggles or face shield
- B. Adjust tool rest to proper clearance

  (NOTE: Proper clearance is approximately $^1/_{16}$ to $^1/_8$ inch from grinding wheel.)

- C. Rotate grinding wheel by hand to be sure that it will clear tool rest
- D. Turn on grinder
- E. Dress grinding wheel

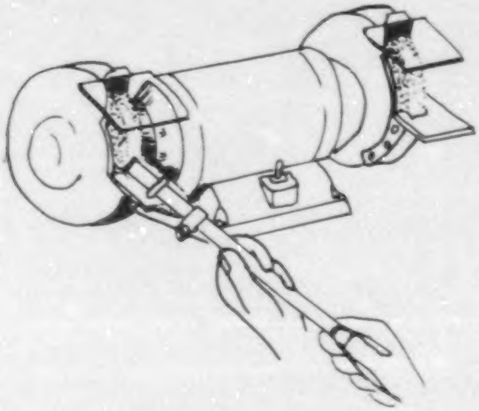
  (NOTE: The following procedures dress and true the wheel by removing ground particles from the pores of the wheel. Also, dull, abrasive grains on the surface of the wheel are fractured away, exposing sharp, new abrasive grains that improve the cutting action of the wheel.)

  1. Rest dressing tool on tool rest (See Figure 71)

JOB SHEET #2

2. Hold tool securely and apply pressure to tool (Figure 71)

FIGURE 71



3. Roll tool across face of grinding wheel

CAUTION

Avoid running the tool off the edge of the wheel as this will cause the edge of the wheel to wear unevenly.

4. Continue dressing wheel until grinding surface is square with sides

5. Turn off grinder

6. Put away tools and equipment and clean work area

MISCELLANEOUS EQUIPMENT
UNIT III

JOB SHEET #3 — USE A BENCH GRINDER TO DRESS AND SHARPEN TOOLS

I. Tools and equipment

   A. Bench grinder

   B. Wheel dressing tool

   C. Goggles or full face shield

   D. Standard screwdriver

   E. Screw (for checking screwdriver)

   F. Cold chisel

   G. Twist drill, 3/8" to 3/4"

   H. Drill point gauge

   I. Container of water

II. Procedure for dressing standard screwdriver blade

   A. Put on goggles or face shield

   B. Dress grinding wheel if needed (See Job Sheet #2)

   C. Adjust tool rest to proper clearance

   (NOTE: Proper clearance is approximately 1/16 to 1/8 inch from grinding wheel.)

   D. Rotate grinding wheel by hand to make sure that it will clear the tool rest

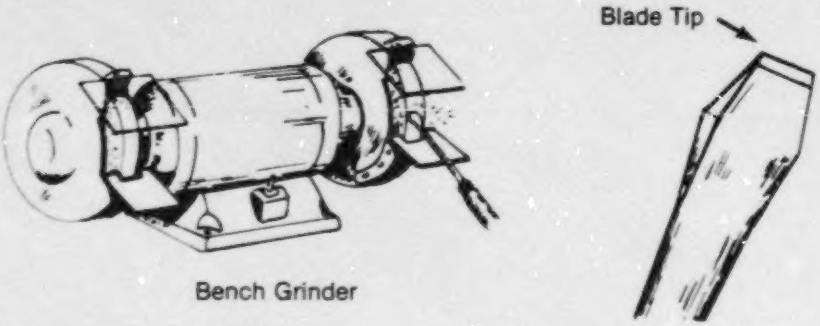
   E. Turn on grinder

JOB SHEET #3

F. Grind tip of screwdriver blade flat and square, dipping tip in water occasionally to keep it from getting too hot (Figure 72)

> **CAUTION**
>
> Do not let the tip of the screwdriver blade become red hot during the grinding process. Such heat will ruin the blade.

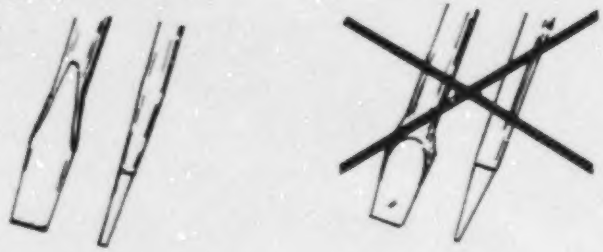
FIGURE 72



Bench Grinder

G. Dress sides of blade, and then turn off grinder (Figure 73)

FIGURE 73

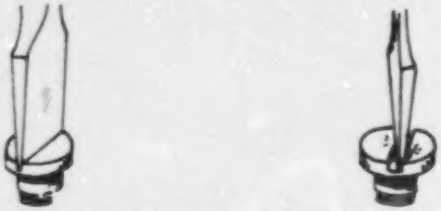


Ground Right

Ground Wrong

H. Test fit of blade with screw (Figure 74)

FIGURE 74



Correct Screwdriver Fit

Incorrect Fit That Damages Screwdriver and Screw Slot

JOB SHEET #3

III. Procedure for dressing a cold chisel

A. Put on goggles or face shield

B. Dress grinding wheel if needed (See Job Sheet #2)

C. Adjust tool rest to proper clearance

(NOTE: Proper clearance is approximately 1/16 to 1/8 inch from grinding wheel.)

D. Rotate grinding wheel by hand to make sure that it will clear tool rest

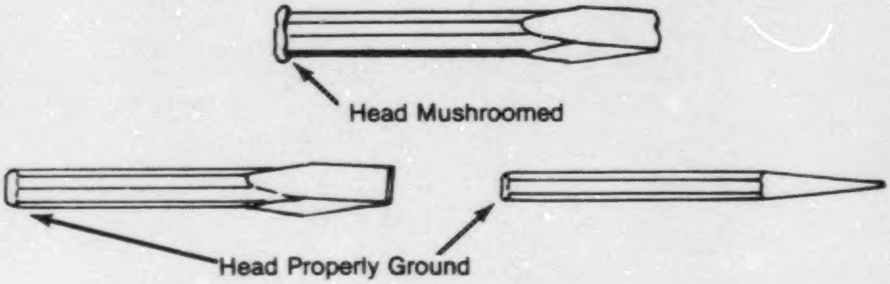
E. Turn on grinder

F. Grind head of chisel, dipping head in water occasionally to keep it from getting too hot (Figure 75)

CAUTION

When the head of a chisel is mushroomed, chips may fly off during grinding.

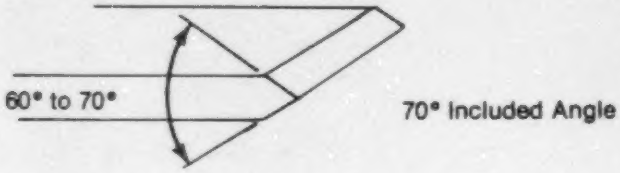
FIGURE 75



G. Grind cutting edge of chisel, dipping tip in water occasionally to keep it from getting too hot

1. Rest chisel on tool rest, apply slight pressure to grinding wheel, and grind cutting edge of chisel to an included angle of 60° to 70° (Figure 76)

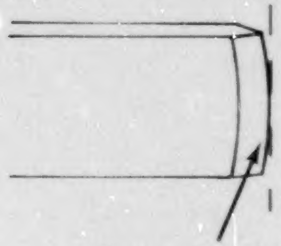
FIGURE 76



JOB SHEET #3

2. Grind cutting edge slightly convex (Figure 77)

FIGURE 77



H. Turn off grinder

IV. Procedure for sharpening a twist drill

A. Put on goggles or face shield

B. Dress grinding wheel if needed (See Job Sheet #2)

C. Adjust tool rest to proper clearance

(NOTE: Proper clearance is approximately 1/16 to 1/8 inch from grinding wheel.)

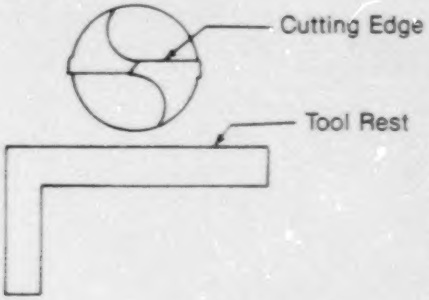
D. Rotate grinding wheel by hand to make sure that it will clear tool rest

E. Turn on grinder

F. Hold drill with one hand on shank and other hand near point

G. Hold lip on cutting edge of drill parallel to tool rest, slightly above center line of grinding wheel (Figure 78)

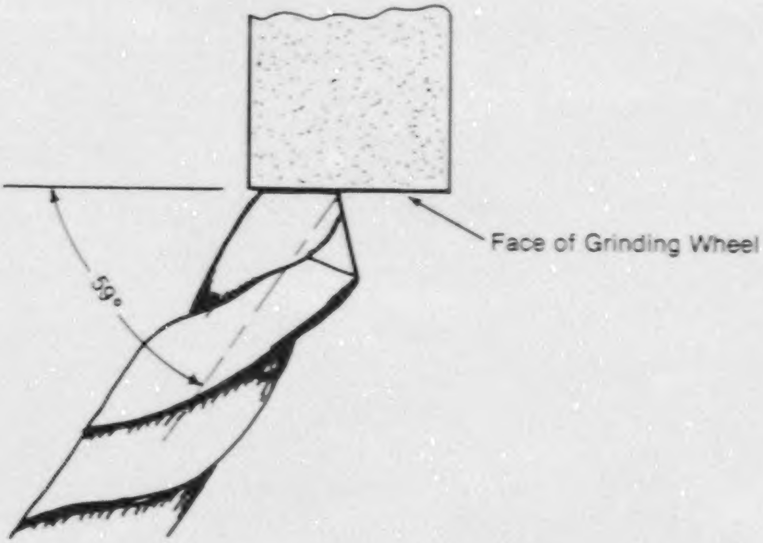
FIGURE 78



JOB SHEET #3

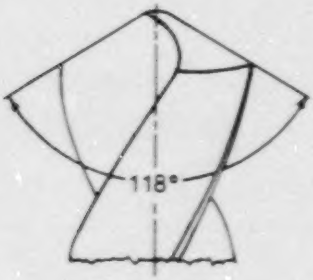
H. Turn drill until its center line is approximately 59 degrees to face of grinding wheel (Figure 79)

FIGURE 79



(NOTE: General-purpose drills used for drilling most machine steels are measured 59 degrees to center line of the drill, thus making the total angle at the drill point 118 degrees. See Figure 80.)

FIGURE 80

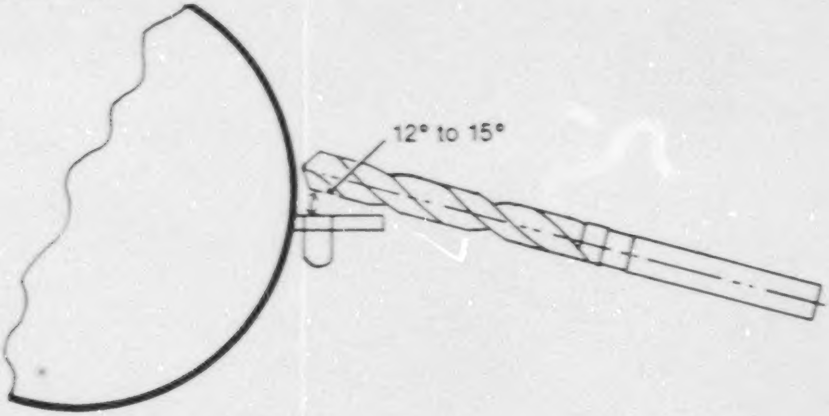


Point Angle

JOB SHEET #3

I. Tilt drill up to approximately a 12- to 15-degree angle, and gently apply to grinding wheel (Figure 81)

FIGURE 81

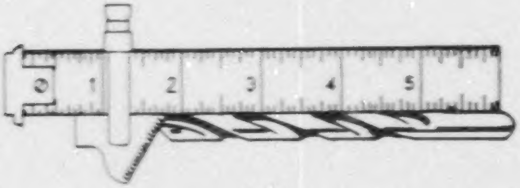


J. Rotate drill slowly in a clockwise motion as you grind, maintaining a 12- to 15-degree angle and dipping tip in water occasionally to keep it from getting too hot

(NOTE: The drill is too hot when it starts to turn a bluish color.)

K. Use drill point gauge to check lip angle and cutting lip length (Figure 82)

FIGURE 82



L. Grind lip on other cutting edge in the same manner, and use drill point gauge to check lip angle and length

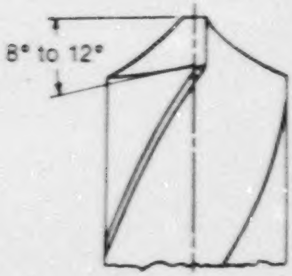
M. Turn off grinder

JOB SHEET #3

N. Repeat procedure until lip angles and lengths are correct (Figures 83-85)

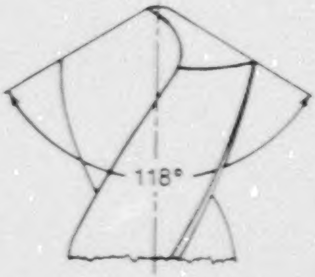
(NOTE: Most difficulties in drilling are caused by improper grinding; therefore, take care with lip clearance, point angle, and chisel-edge angle.)

FIGURE 83



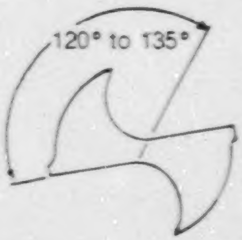
Lip Clearance

FIGURE 84



Point Angle

FIGURE 85



Chisel-Edge Angle

O. Put away tools and equipment and clean work area

MISCELLANEOUS EQUIPMENT
UNIT III

TEST

NAME ______________________________ SCORE ______________

1. Match to their correct definitions terms associated with miscellaneous equipment. Write the correct numbers in the blanks.

_____a. Any small member used primarily to support another member or structure

_____b. Wheel used to support scaffold; mounted in a swivel frame and usually furnished with brakes

_____c. Four-inch guardrails attached ¼ inch above scaffold platform to prevent tools and materials from falling from scaffold

_____d. Guardrails attached on scaffolds about 42 inches high and midway between 42 inches and toeboard

_____e. Short member on which the scaffold planks or platform is laid and attached

_____f. Safety device on bottom of ladders; used to prevent ladder heel from sliding

_____g. Federal legislation designed to ensure safe and sanitary working conditions for employees

_____h. Angle-shaped devices manufactured to fasten on forms in pairs to support a platform for workers and material

_____i. Rope used to guide or steady a load being hoisted

_____j. Heavy pieces of wood nailed together to form pads about 18 inches square; used on ground to support scaffolds

_____k. Type of scaffold normally hung from top of a structure for which it is not practical to build a scaffold

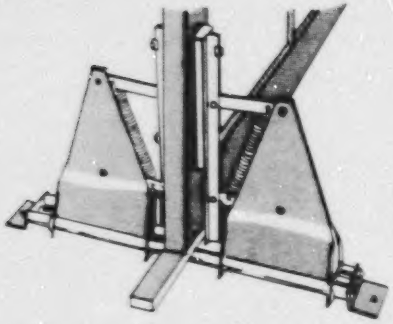
_____l. Scaffold that is constructed and set up on the site where it is to be used

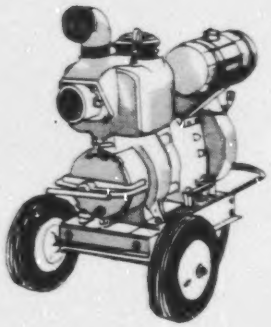
1. Putlog
2. Tagline
3. Bearer
4. Mudpads
5. Safety shoe
6. Caster
7. OSHA (Occupational Safety and Health Act)
8. Swinging scaffold (stage)
9. Toeboards
10. Job-built scaffold
11. Scaffold jacks
12. Safety rails

TEST

2. Identify the following miscellaneous equipment used by carpenters. Write the correct names in the blanks.

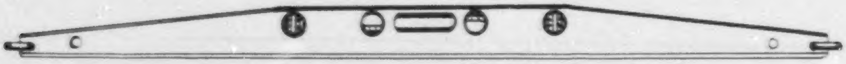
Door jamb level
Door jack (door holder)
Door-hanging kit
Lock installation boring jig
Cabinet door routing template
Bolt cutters
Chain saw
Stilts
Wheelbarrow
Gasoline air compressor
Electric air compressor
Space heater
Alternator
Angle grinder
Vacuum cleaner and accessories
Centrifugal water pump
Stepladder
Extension ladder
Single, straight ladder
Prefabricated scaffold
Tubular locking scaffold
Swinging scaffold
Single-pole scaffold
Double-pole scaffold
Scaffold jacks with platform
Bench grinder
Push broom
Spade (sharpshooter)
Scoop shovel
Long-handled, round-point shovel
Long-handled, square-point shovel
Sawbuck (sawhorse)
Hand broom
Bench brush





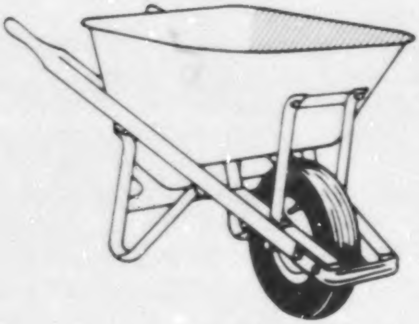
a. ______________________

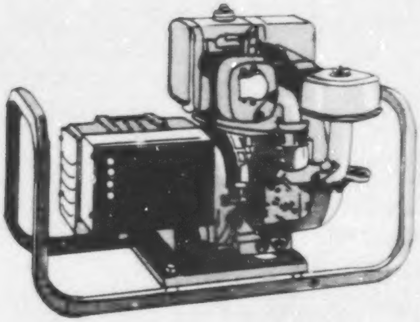
b. ______________________



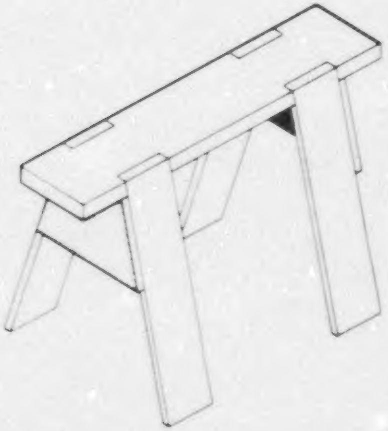
c. ______________________

TEST



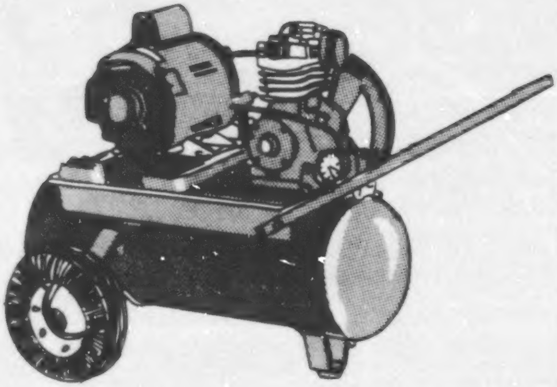


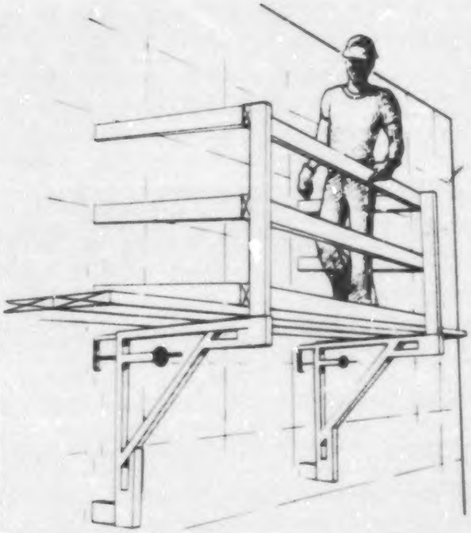
d. ______________________ e. ______________________



f. ______________________

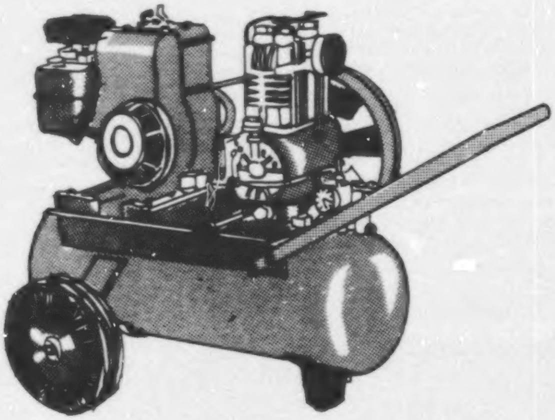
TEST

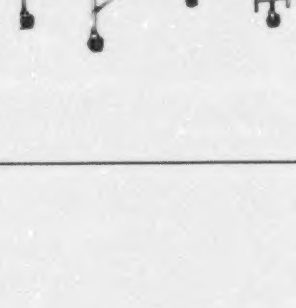




g. ________________________

h. ________________________

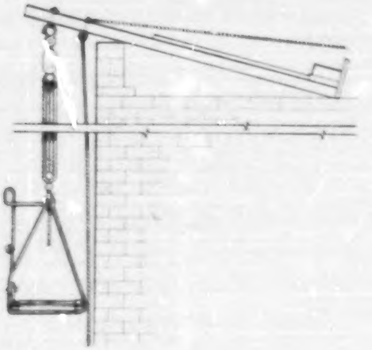


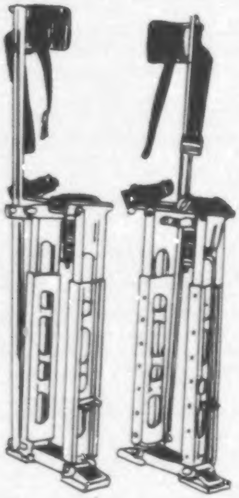


i. ________________________

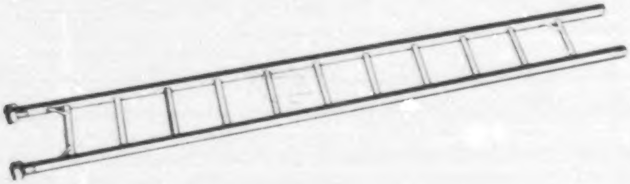
j. ________________________

TEST

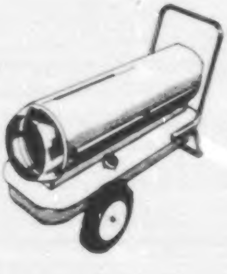


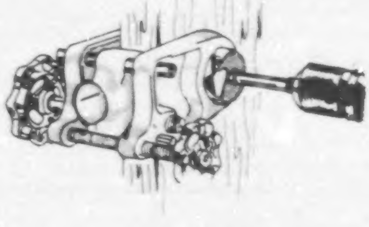


k. ______________________________ l. ______________________________



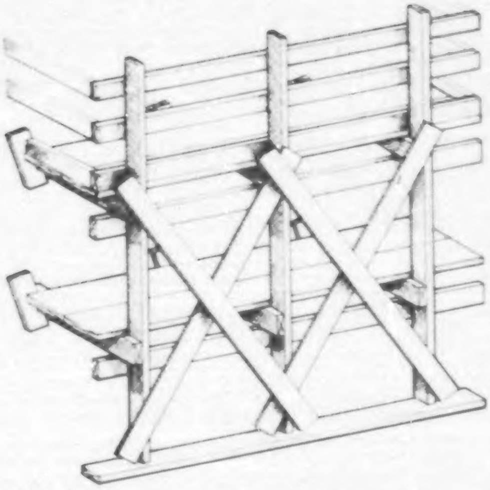
m. ______________________________

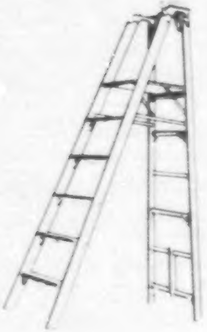




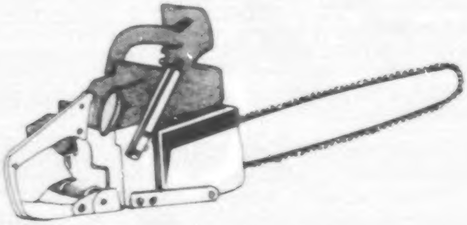
n. ______________________________ o. ______________________________

TEST

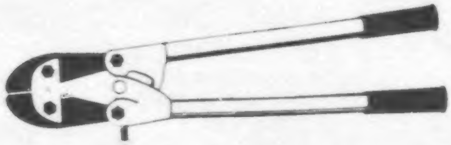


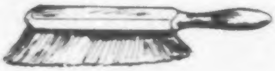


p. ______________________________ q. ______________________________



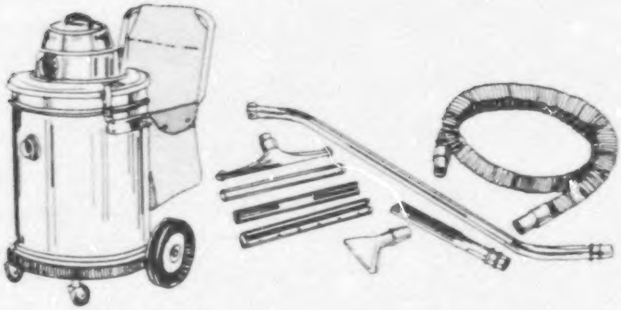
r. ______________________________



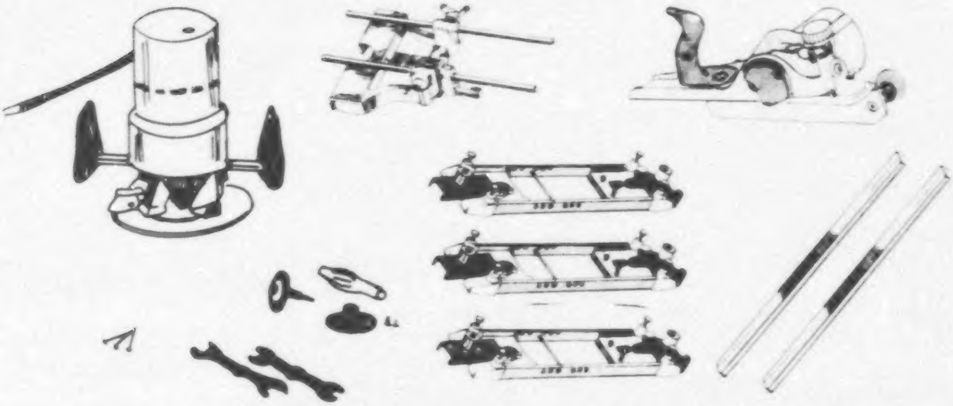


s. ______________________________ t. ______________________________

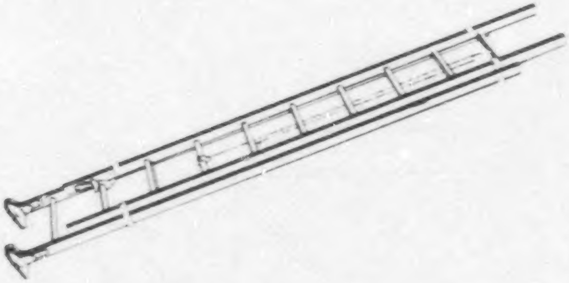
TEST



u. ______________________________

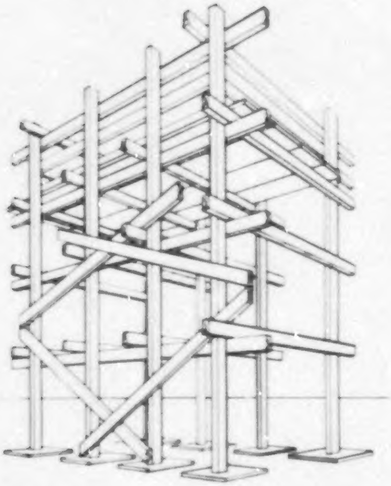


v. ______________________________

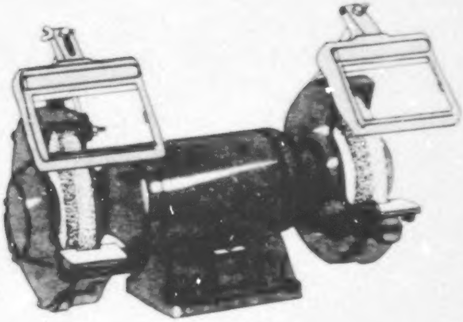


w. ______________________________

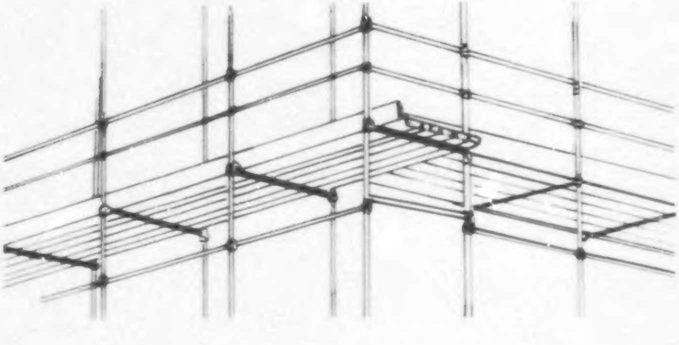
TEST



x. ______________________________

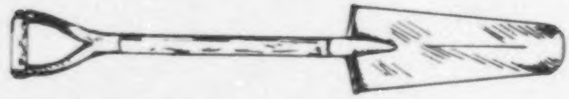


y. ______________________________

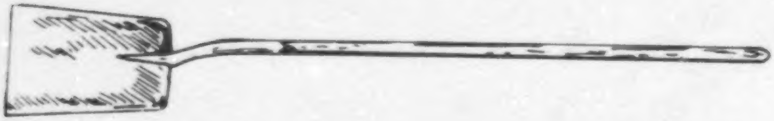


z. ______________________________

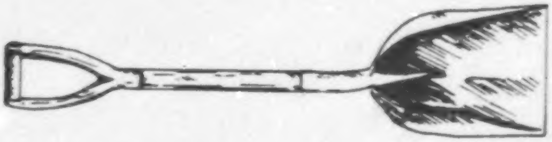
TEST



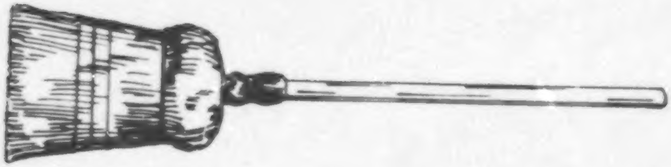
aa. ______________________________



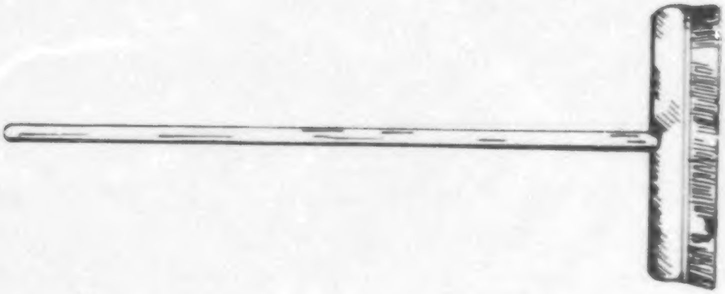
bb. ______________________________



cc. ______________________________

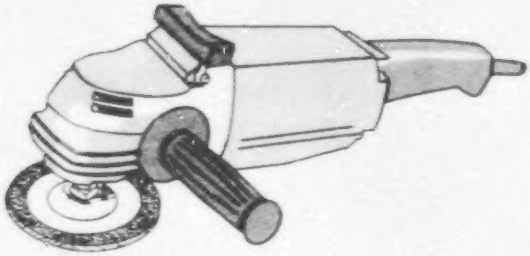


dd. ______________________________

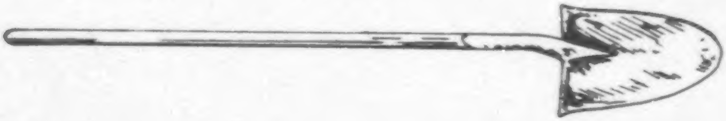


ee. ______________________________

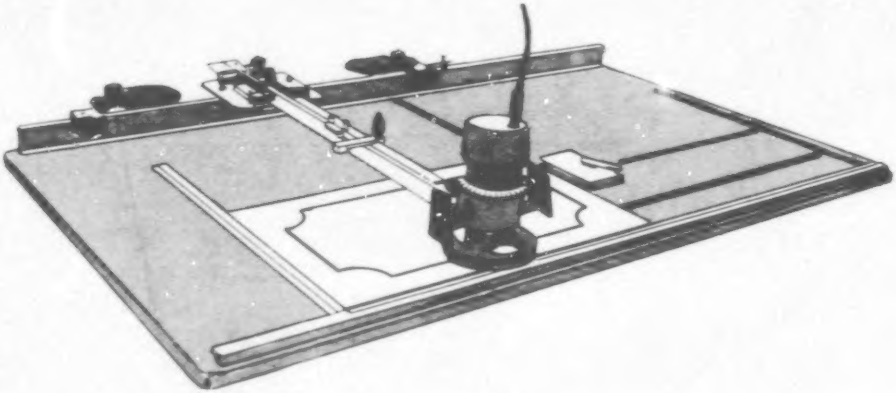
TEST



ff. ______________________________



gg. ______________________________

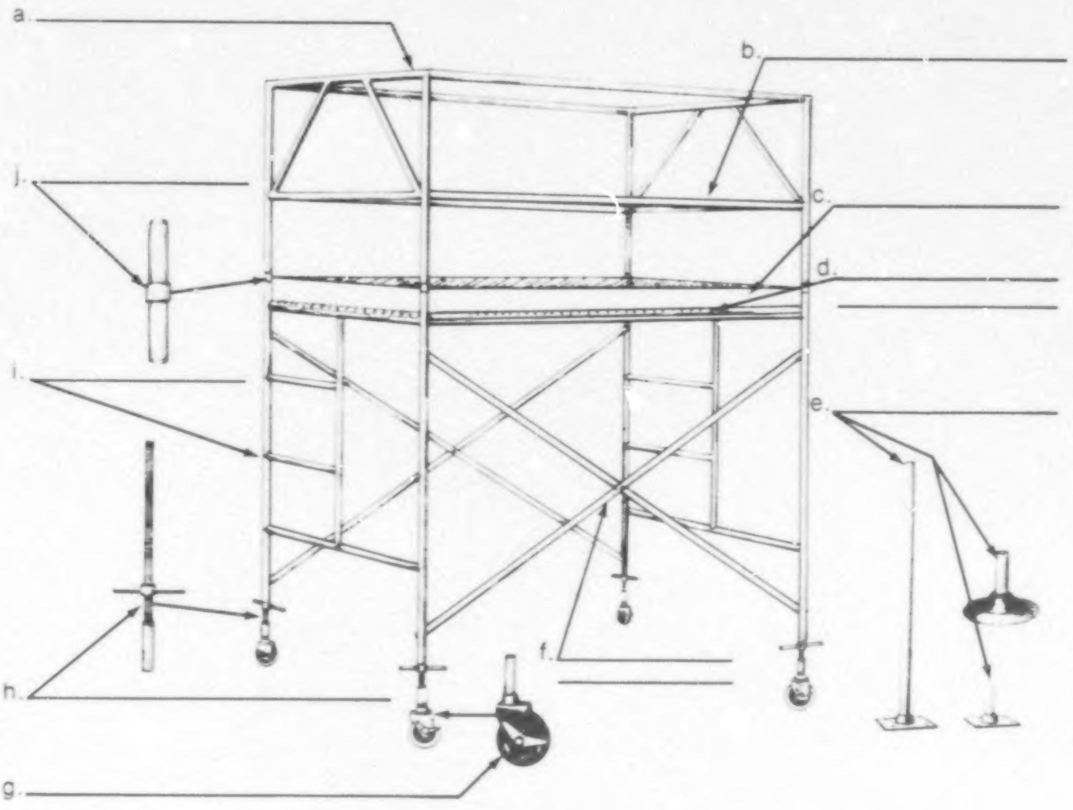


hh. ______________________________

TEST

3. Identify the parts of the prefabricated rolling scaffold illustrated below. Write the correct names in the blanks.

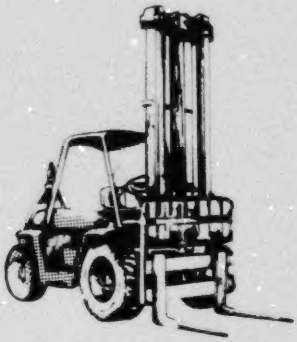
Crossbrace
Screw jack
Top guardrail
Middle guardrail
Base plates
Scaffold planks or platform
Toeboard
Caster
End frame
Coupling pin

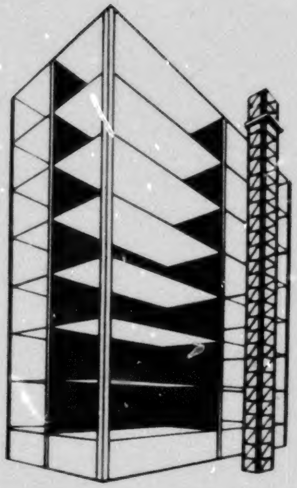


TEST

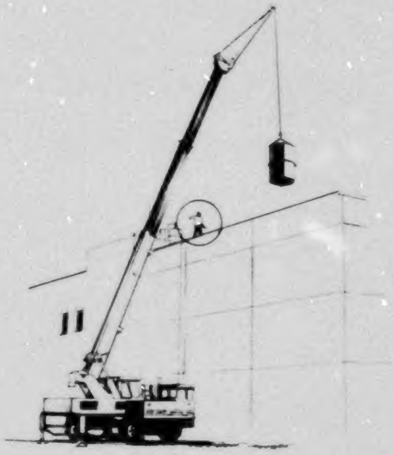
4. Identify the following equipment used for specific construction jobs. Write the correct names in the blanks.

Mobile crane	**Power buggy**
Tower crane	**Forklift**
Hoist	**Conveyor**



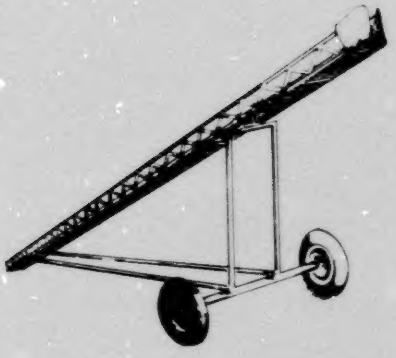


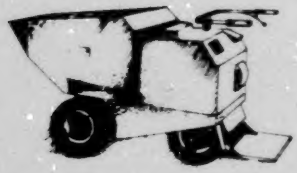
a. ______________________ b. ______________________



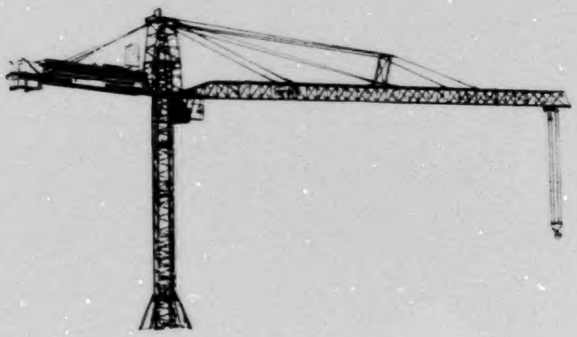
c. ______________________

TEST





d. ______________________________ e. ______________________________



f. ______________________________

5. State safety precautions pertaining to miscellaneous equipment.

General

a. ______________________________

b. ______________________________

c. ______________________________

TEST

Scaffolding and rigging (state five)

a. ______________________________

____

b. ______________________________

____

c. ______________________________

____

d. ______________________________

____

e. ______________________________

____

Ladders (state six)

a. ______________________________

____

b. ______________________________

____

c. ______________________________

____

d. ______________________________

____

e. ______________________________

____

f. ______________________________

____

TEST

Grinders

a. ______________________________

____

b. ______________________________

____

c. ______________________________

____

d. ______________________________

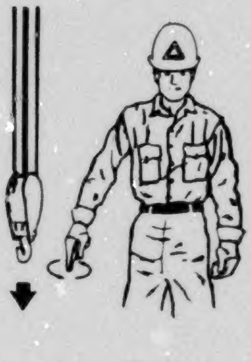
____

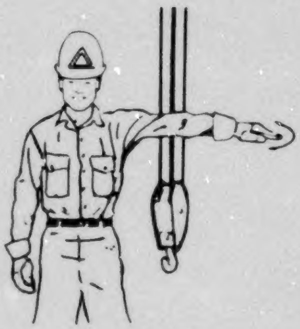
e. ______________________________

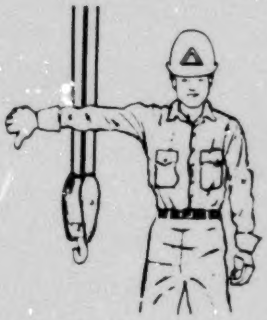
____

6. Distinguish among the following hand signals used in rigging and maneuvering operations. Write an "X" in the blanks below each correct illustration.

   a. Lower boom



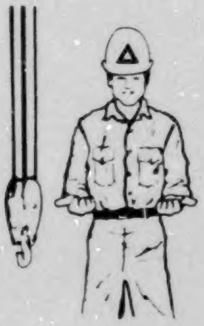


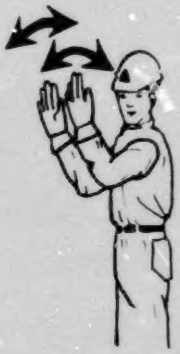


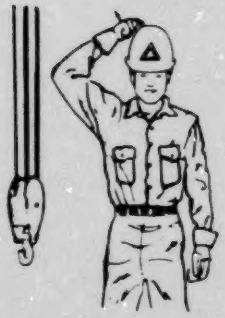
1) ______________ 2) ______________ 3) ______________

TEST

b. Straighten out

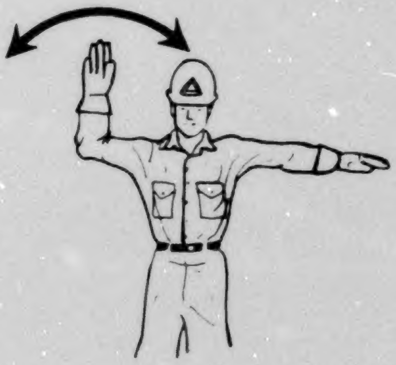


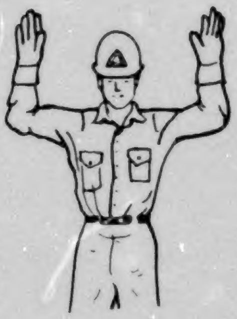


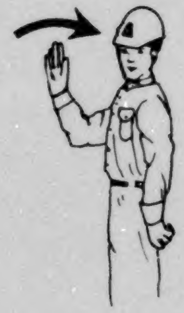


1) ________________ 2) ________________ 3) ________________

c. Move backward



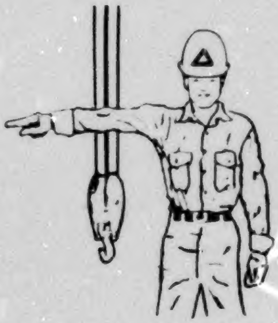


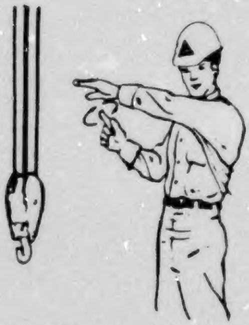


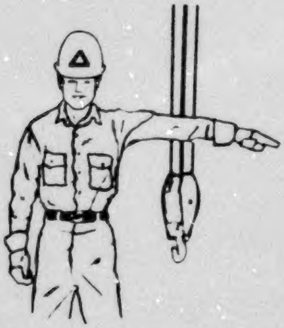
1) ________________ 2) ________________ 3) ________________

TEST

d. Swing

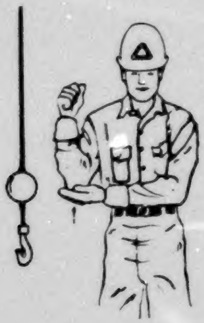


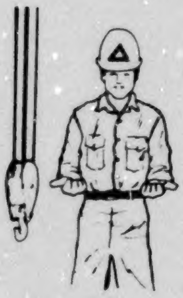


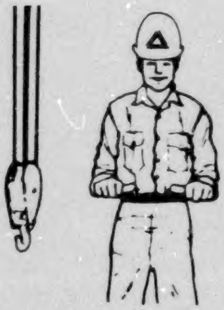


1) ______________ 2) ______________ 3) ______________

e. Retract boom



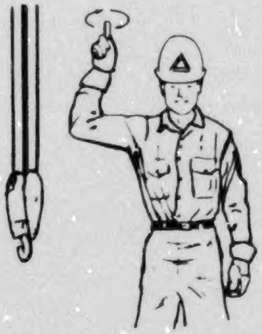


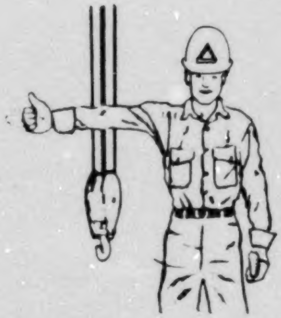


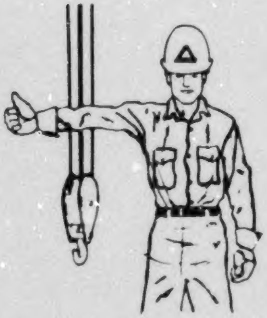
1) ______________ 2) ______________ 3) ______________

TEST

f. Raise boom and lower load





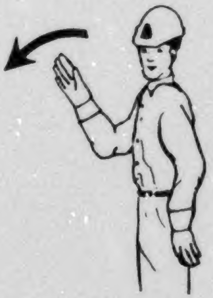


1) ______________ 2) ______________ 3) ______________

g. _____ 1) Swing in this direction

_____ 2) Move forward

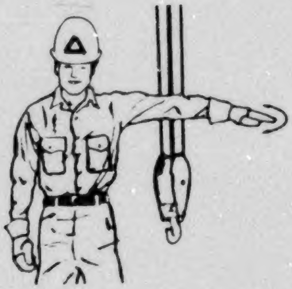
_____ 3) Turn while moving



h. _____ 1) Swing

_____ 2) Stop

_____ 3) Emergency stop



(NOTE: Test question 7 lists the job sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

7. Demonstrate the ability to

   a. Set up a section of scaffolding.

   b. Dress a grinding wheel.

   c. Use a bench grinder to dress and sharpen tools.

MISCELLANEOUS EQUIPMENT
UNIT III

ANSWERS TO TEST

1. a. 3
   b. 6
   c. 9
   d. 12
   e. 1
   f. 5
   g. 7
   h. 11
   i. 2
   j. 4
   k. 8
   l. 10

2. a. Door jack (door holder)
   b. Centrifugal water pump
   c. Door jamb level
   d. Wheelbarrow
   e. Alternator
   f. Sawbuck (sawhorse)
   g. Electric air compressor
   h. Scaffold jacks with platform
   i. Gasoline air compressor
   j. Prefabricated scaffold
   k. Swinging scaffold
   l. Stilts
   m. Single, straight ladder
   n. Space heater
   o. Lock installation boring jig
   p. Single-pole scaffold
   q. Stepladder
   r. Chain saw
   s. Bolt cutters
   t. Bench brush
   u. Vacuum cleaner and accessories
   v. Door-hanging kit
   w. Extension ladder
   x. Double-pole scaffold
   y. Bench grinder
   z. Tubular locking scaffold
   aa. Spade (sharpshooter)
   bb. Long-handled, square-point shovel
   cc. Scoop shovel
   dd. Hand broom
   ee. Push broom
   ff. Angle grinder
   gg. Long-handled, round-point shovel
   hh. Cabinet door routing template

3. a. Top guardrail
   b. Middle guardrail
   c. Toeboard
   d. Scaffold plank or platform
   e. Base plates
   f. Crossbrace
   g. Caster
   h. Screw jack
   i. End frame
   j. Coupling pin

4. a. Forklift
   b. Hoist
   c. Mobile crane
   d. Conveyor
   e. Power buggy
   f. Tower crane

5. **General**

   a. Do not remove safety devices from equipment
   b. Do not use heaters or gasoline-powered equipment in an unventilated area
   c. Check condition of all equipment before using; always mark damaged equipment and report it to your instructor or supervisor

ANSWERS TO TEST

Scaffolding and rigging (Answer should include any five of the following)

a. Always check for electrical wires and deenergize before erecting metal scaffolding in the vicinity
b. Be sure that wheels are locked on rolling scaffolds before ascending
c. Do not work on scaffolds during storms, high winds, or when scaffolds are covered with ice or snow
d. Tie off scaffolds about every 25 feet when they are built several sections high
e. Do not overload scaffolds
f. Be sure that scaffolds are equipped with top rail (42 inches high), midrail, and toeboard
g. Use safety belts, harness, and nets as required
h. Check safe working load of all rigging used
i. Exercise extreme caution when moving cranes and other hoisting equipment

Ladders (Answer should include any six of the following)

a. Fully spread and lock any stepladder before using
b. Do not use ladders that are not equipped with safety shoes
c. Never overreach from a ladder
d. Never work from the top step of any ladder
e. Never use a metal ladder when there is any possibility of contact with electrical conductors
f. Never use ladders in a horizontal position
g. Do not climb on a ladder that is occupied by someone else
h. Remove ladder when you are finished using it, and always remove and store ladder at end of workday
i. Place ladders approximately one-quarter of their support length away from vertical plane of top support, and extend ladders a minimum of 3 feet above top support
j. Secure ladders at both top and bottom to prevent displacement; brace long ladders at intermediate points to prevent spring

Grinders

a. Be sure to use proper type and size grinding wheel for job being done
b. Always operate grinder at recommended speed
c. Be sure that grinding wheel is properly mounted on spindle
d. Never stand in front of grinder when starting
e. Always wear safety goggles when operating grinder

6. a. 3   e. 3
b. 2   f. 2
c. 3   g. 2
d. 1   h. 3

7. Performance skills evaluated to the satisfaction of the instructor

BUILDER'S LEVEL AND TRANSIT
UNIT I

UNIT OBJECTIVE

After completing this unit, the student should be able to use a builder's level, combination level-transit, and transit. The student will show this knowledge by completing the assignment sheets, job sheets, and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match to their correct definitions terms associated with leveling instruments.
2. Discuss *stadia reticle.*
3. List uses of a level.
4. Identify types of levels.
5. Identify parts of a builder's level.
6. List uses of a transit.
7. Identify types of transits.
8. Label major components of an engineer's transit.
9. Identify parts of an engineer's transit.
10. Label vertical and horizontal cross hairs and line of sight on a leveling instrument.
11. State rules for proper care of leveling instruments.
12. Identify parts of a leveling rod.
13. Match parts of a leveling rod to their correct uses.
14. Describe commonly used direct-reading rods.
15. Read a direct-reading rod.
16. Identify hand signals used by the instrument person to guide the rod person.

OBJECTIVE SHEET

17. Demonstrate the ability to

    a. Set up and adjust a builder's level.

    b. Use a builder's level to check footing elevations.

    c. Use a builder's level to perform differential leveling.

    d. Connect plumb bob to transit.

    e. Set up and adjust a combination level-transit.

    f. Use a combination level-transit to locate building-line points on batter boards.

BUILDER'S LEVEL AND TRANSIT
UNIT I

SUGGESTED ACTIVITIES

I. Unit contents

A. Objective sheet

B. Suggested activities

C. Transparency masters

1. TM #1 — Reading a Leveling Rod Graduated in Eighths of an Inch

2. TM #2 — Reading a Leveling Rod Graduated in Hundredths of a Foot

D. Information sheet

E. Assignment sheets

1. Assignment Sheet #1 — Read Leveling Rods

2. Assignment Sheet #2 — Distinguish Among Hand Signals Used by the Instrument Person to Guide the Rod Person

F. Answers to assignment sheets

G. Job sheets

1. Job Sheet #1 — Set Up and Adjust a Builder's Level

2. Job Sheet #2 — Use a Builder's Level to Check Footing Elevations

3. Job Sheet #3 — Use a Builder's Level to Perform Differential Leveling

4. Job Sheet #4 — Connect Plumb Bob to Transit

5. Job Sheet #5 — Set Up and Adjust a Combination Level-Transit

6. Job Sheet #6 — Use a Combination Level-Transit to Locate Building-Line Points on Batter Boards

H. Test

I. Answers to test

II. Instructor's guide

A. Review unit and plan presentation.

SUGGESTED ACTIVITIES

1. Review Job Sheet #2. You will need to locate a site and arrange practice elevations on footings as shown in the drawing accompanying the job sheet, or you may prefer to assign other practice elevations and to have the job performed on a shop floor or on a parking lot.

2. Review Job Sheet #3. You will need to locate a site and arrange practice elevations as shown in the drawing accompanying the job sheet, or you may prefer to assign other practice elevations.

3. Review Job Sheet #6. You will need to locate a site, mark property-line points, and erect batter boards as shown in the drawings accompanying the job sheet.

B. Obtain materials to supplement unit.

1. Transparencies and competency profiles

   (NOTE: Transparencies and competency profiles for this book are available from the Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074, or from The Associated General Contractors of America, 1957 E Street, N.W., Washington, D.C. 20006, phone 202-393-2040.)

2. Filmstrips

   (NOTE: The following color filmstrips come with a manual and may be ordered from the California State Polytechnic University, San Luis Obispo, California 93407.)

   a. *Setting Up the Instrument.*

   b. *Reading the Rod.*

C. Introduce unit to students.

SUGGESTIONS:

- Invite an instrument salesperson or a surveyor to display and discuss the cost, use, and proper care of the various types of leveling instruments.
- Visit a construction site to let the students observe leveling instruments in use.
- Explain to students that the instruments may look complicated but are relatively easy to use; emphasize that the instruments must be used carefully and skillfully in order to get accurate readings.

D. Provide students with objective sheet.

E. Discuss unit and specific objectives.

SUGGESTED ACTIVITIES

F. Provide students with information, assignment, and job sheets.

G. Discuss information, assignment, and job sheets.

1. Use Information Sheet, Sections I and II to discuss terms and definitions associated with leveling instruments.

   SUGGESTIONS:

   - Show students actual instruments—such as a builder's level, laser-beam instrument, and transit—and examples of other objects—such as a field book, leveling rod, grade stake, and plumb bob.
   - Take the students to a construction site to demonstrate surveying and concepts such as slope, elevation, fall, bench mark, finish-floor height, grade line, etc.
   - Set up a transit and a builder's level, and have students look through the telescopes to reinforce your discussion of reticle and stadia, cross hairs, and line of sight.
   - Demonstrate stadia reticle.

2. Use Information Sheet, Section III to discuss uses of a level.

   SUGGESTION:

   - Compare the uses of transits and levels, emphasizing when it is more appropriate to use a level.

3. Use Information Sheet, Section IV to discuss types of levels.

   SUGGESTIONS:

   - Show students examples of the various types of levels illustrated in the information sheet.
   - Discuss the uses of the various types of levels, emphasizing the possible advantages and disadvantages of each type.

4. Use Information Sheet, Section V to discuss the parts of a builder's level.

   SUGGESTIONS:

   - Explain to students that the engineer's level is the type of level that they are most likely to encounter on the job.
   - Set up a builder's level, point out the parts of the level illustrated in the information sheet, and demonstrate all movements of the instrument.

SUGGESTED ACTIVITIES

5. Use Information Sheet, Section VI to discuss uses of a transit.

   SUGGESTION:

   - Compare the uses of transits and levels, emphasizing when it is more appropriate to use a transit.

6. Use Information Sheet, Section VII to discuss types of transits.

   SUGGESTIONS:

   - Show the students examples of the various types of transits illustrated in this section of the information sheet.

   - Discuss the level-transit, emphasizing that, as the name suggests, it is a combination tool that is becoming very popular in construction.

   - Discuss the uses of the various types of transits, emphasizing the possible advantages and disadvantages of each type.

7. Use Information Sheet, Sections VIII and IX to discuss the major components and parts of an engineer's transit.

   SUGGESTIONS:

   - Explain to students that the engineer's transit is the type of transit that they are most likely to encounter on the job.

   - Set up an engineer's transit, point out the components and parts illustrated in the information sheet, and demonstrate all movements of the instrument.

8. Use Information Sheet, Section X to discuss vertical and horizontal cross hairs and line of sight on a leveling instrument.

   SUGGESTION:

   - Set up various leveling instruments and allow students to sight through each instrument to identify vertical and horizontal cross hairs and to locate line of sight.

9. Use Information Sheet, Section XI to discuss the proper care of leveling instruments.

   SUGGESTIONS:

   - Discuss the cost of leveling instruments and emphasize the delicacy of the instruments.

SUGGESTED ACTIVITIES

- Show the filmstrip *Setting Up the Instrument.*
- Demonstrate to students the proper procedure for removing a builder's level from its carrying case and for setting up the instrument; acquaint students with your rules for student use of the instrument.
- Have students complete Job Sheet #1.
- Demonstrate to students the proper procedures for removing transits and level-transits from their carrying cases, setting up the instruments, and attaching a plumb bob to the instruments; acquaint students with your rules for student use of the instruments.
- Have students complete Job Sheets #4 and #5.

10. Use Information Sheet, Section XII and XIII to discuss the parts of a leveling rod and their correct uses.

    SUGGESTION:

    - Use an actual rod to point out the parts illustrated in the information sheet and to demonstrate the correct use of each part.

11. Use Information Sheet, Section XIV to discuss commonly used direct-reading rods.

    SUGGESTIONS:

    - Show the students an example of each type of direct-reading rod and discuss when it is more appropriate to use one or the other.
    - Show the filmstrip *Reading the Rod.*

12. Use Information Sheet, Section XV to discuss reading a direct-reading rod.

    SUGGESTIONS:

    - Use Transparencies #1 and #2 to illustrate information presented in this section of the information sheet.
    - Have students practice reading a direct-reading rod by completing Assignment Sheet #1.

13. Use Information Sheet, Section XVI to discuss hand signals used by the instrument person to guide the rod person.

    SUGGESTIONS:

    - Demonstrate each of the hand signals illustrated in the information sheet.

SUGGESTED ACTIVITIES

- Have students practice recognizing hand signals by completing Assignment Sheet #1.
- Allow the students to practice giving the signals to each other in the shop or in the field.

14. Have students review material presented in Information Sheet, Sections X through XVI, and then divide class into teams of two to complete Job Sheets #2, #3, and #6.

H. Review information.

I. Give test.

J. Critique test and discuss in class.

K. Complete appropriate section of competency profiles.

III. Unit references

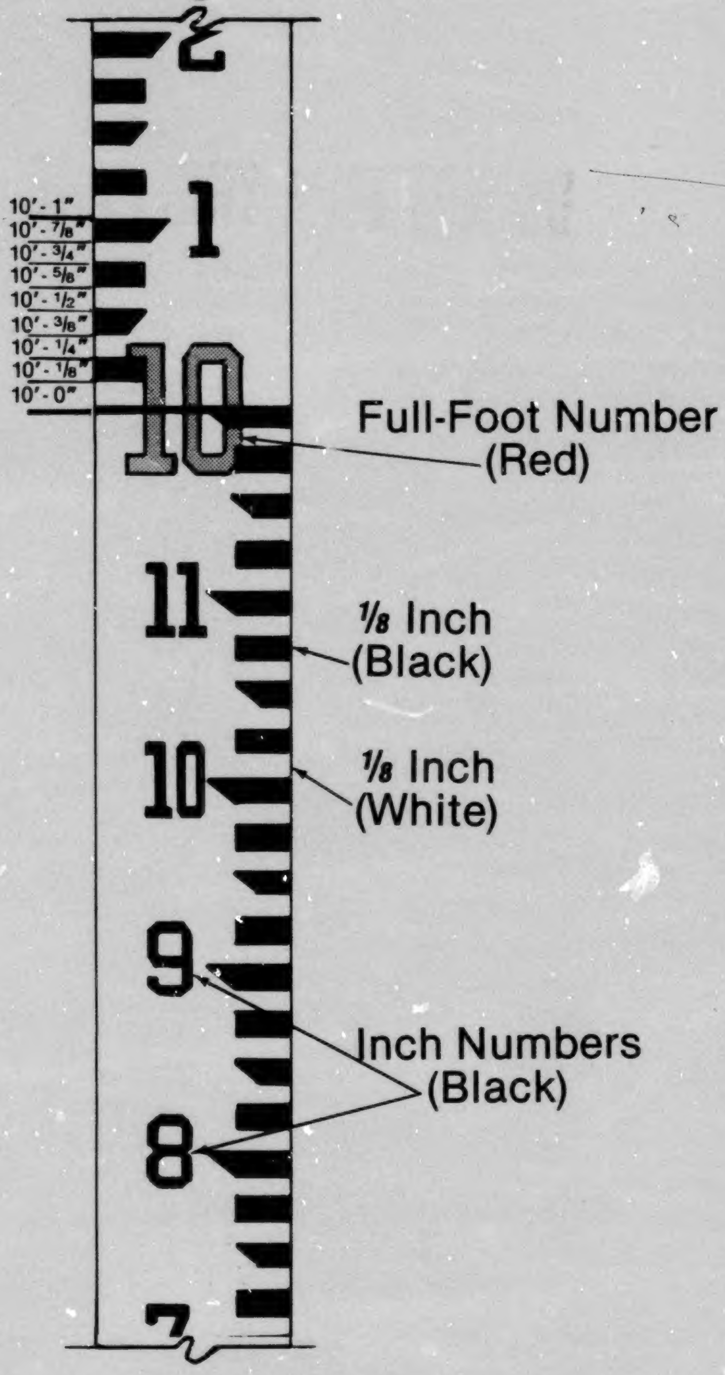
A. Hendrix, Laborn J. "Bud." *Bricklaying Curriculum*. Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, and The Associated General Contractors of America, 1983.

B. Hendrix, Laborn J. "Bud." *Millwright Instructional Materials*. Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, and The Associated General Contractors of America, 1980.

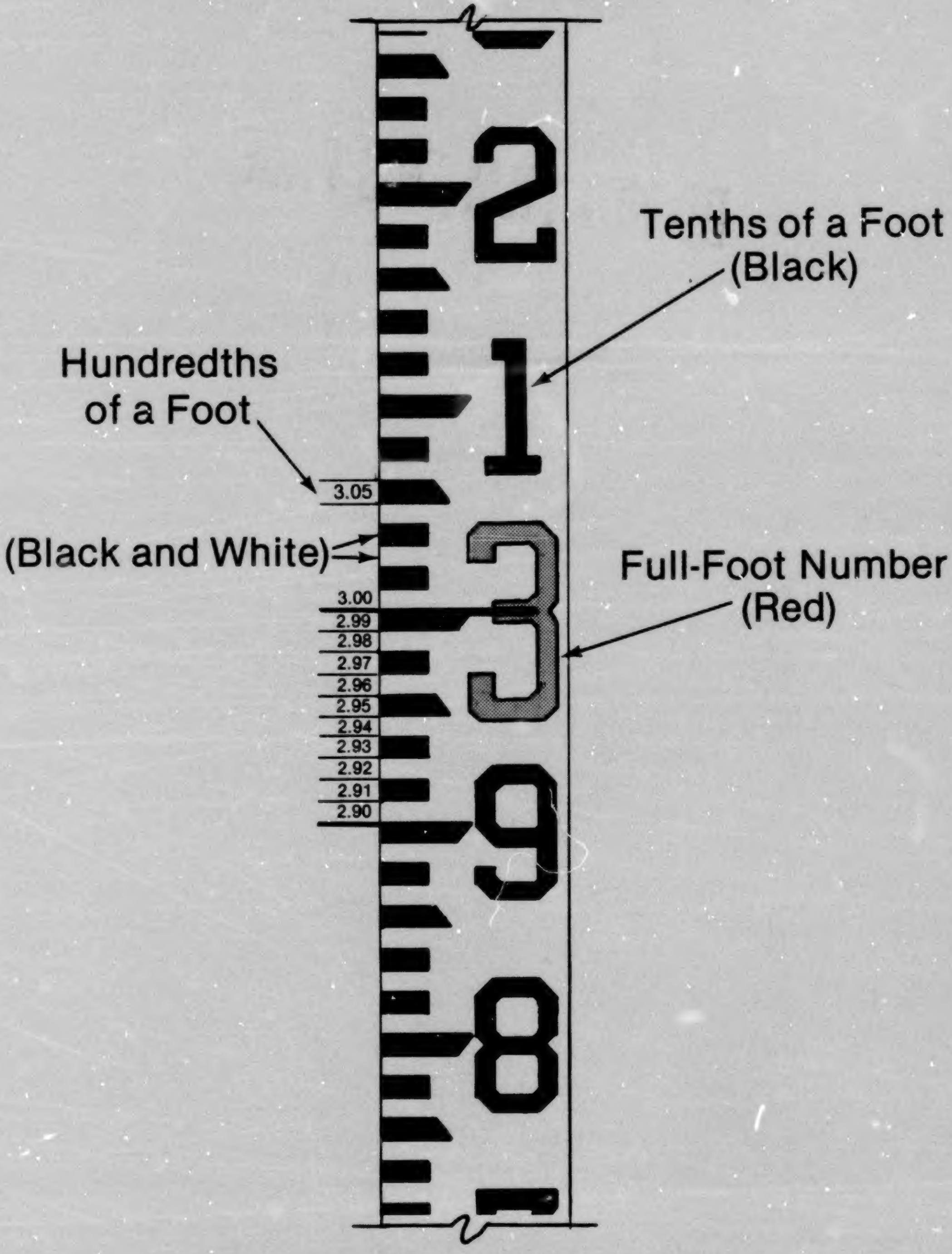
C. Kissam, Philip. *Surveying Practice*, 2nd ed. New York: McGraw-Hill Book Company, 1971.

D. White, David. *Builders/Contractors Instruments*. Menomonee Falls, Wisconsin: Division of Realist, Inc., n.d.

Reading a Leveling Rod Graduated in Eighths of an Inch


2
1
10'- 1"
10'- 7/8"
10'- 3/4"
10'- 5/8"
10'- 1/2"
10'- 3/8"
10'- 1/4"
10'- 1/8"
10'- 0"
10
Full-Foot Number (Red)
11
1/8 Inch (Black)
10
1/8 Inch (White)
9
Inch Numbers (Black)
8
7

Reading a Leveling Rod Graduated in Hundredths of a Foot


Tenths of a Foot
(Black)
Hundredths
of a Foot
(Black and White)
Full-Foot Number
(Red)
2
1
3
9
8
3.05
3.00
2.99
2.98
2.97
2.96
2.95
2.94
2.93
2.92
2.91
2.90

BUILDER'S LEVEL AND TRANSIT
UNIT I

INFORMATION SHEET

I. Terms associated with leveling instruments

A. Builder's level — Leveling instrument consisting of a telescope and leveling bubble; used with a tripod and leveling rod primarily for establishing grade levels

B. Bench mark (BM) — Permanent point of known or assumed elevation

(NOTE: The bench mark may be a specific point on a curb or culvert.)

C. Cross hairs — Fine horizontal and vertical lines in telescope of leveling instrument; used as reference lines in the field or for marking instrumental axis

D. Differential leveling — Leveling method by which the difference in elevation between two points is determined by plus and minus rod readings that are totaled and adjusted to bench mark

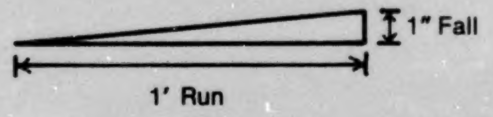
E. Elevation — Given grade

F. Fall — Difference between elevations of two points on a slope (Figure 1)

(NOTE: The fall is usually expressed in inches per foot.)

EXAMPLE: One-inch fall per 1 foot of run

FIGURE 1



G. Field book — Small book used to record instrument readings for layout and elevations of proposed structures

H. Finish-floor height — Elevation of finished floor in relation to bench mark

I. Grade line — Proposed or future level of ground at construction line

J. Grade stake — Stake driven into ground at proposed grade

(NOTE: The grade stake is read from the bench mark.)

K. Height of instrument (HI) — Vertical distance from bench mark to line of sight of leveling instrument

L. Laser-beam instrument — Automatic level that uses a laser beam to establish elevation readings

INFORMATION SHEET

M. Leveling rod — Rod with markings graduated upward from zero; used with leveling instruments to determine elevations

N. Line of sight — Line from an observer's eye to a distant point toward which he or she is directing a leveling instrument

O. Magnetic bearing — Bearing relative to magnetic north

P. Plumb bob — Tool or device attached to a string; used to set and check the vertical or perpendicular of a surface

Q. Reticle — System of lines or cross hairs in the focus of the eyepiece of an optical instrument

R. Site — Plot of ground on which a project is to be constructed

S. Stadia — Surveying method for determining distances and differences of elevation through means of a transit and rod

T. Surveying — Art or science of determining area and configuration of portions of the earth's surface with a maximum of accuracy

U. Temporary bench mark (TBM) — Elevation reference point used when the permanent point is not in sight

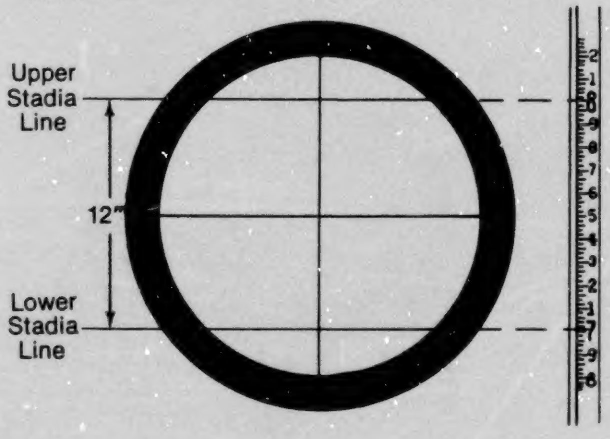
V. Transit — Very precise leveling instrument used to establish straight lines and to measure horizontal and vertical angles

II. Stadia reticle — Additional horizontal lines in telescope eyepiece; used to determine distance between leveling rod and plumb bob (Figure 2)

(NOTE: Stadia ratio is 1:100, which indicates that the rod reading between the upper and lower stadia lines multiplied by 100 is the distance from center of the instrument to the rod.)

EXAMPLE:

FIGURE 2



Reading Between Stadia Lines: 8′ − 7′ = 1′

Distance from Rod to Plumb Bob: 1′ × 100 = 100′

INFORMATION SHEET

III. Uses of a level

   A. Establishing elevations and grades

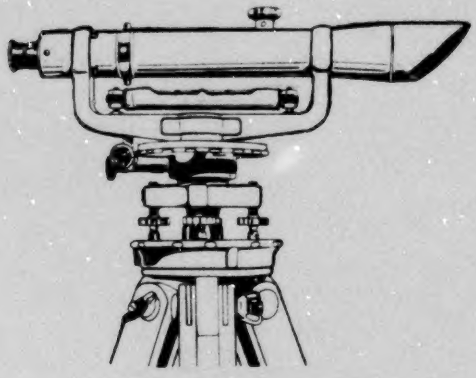
   B. Establishing differential elevations

   C. Transferring elevations from one point to another

IV. Types of levels (Figures 3-9)

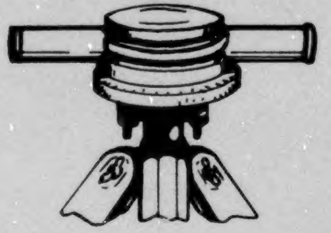
   A. Builder's level

FIGURE 3



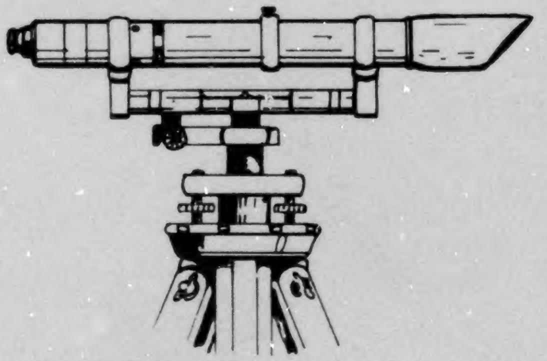
   B. Turret level

FIGURE 4



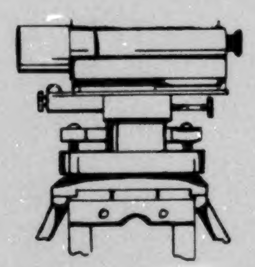
   C. Engineer's dumpy level

FIGURE 5



   D. Engineer's wild-tilting level

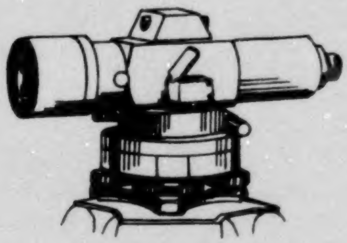
FIGURE 6



INFORMATION SHEET

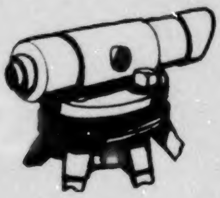
E. Automatic level

FIGURE 7



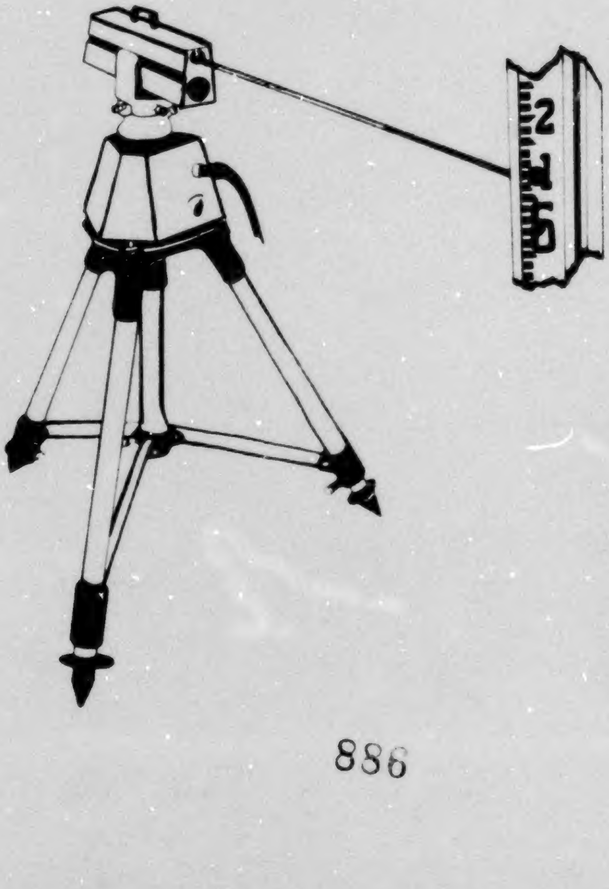
F. Engineer's Zeiss level

FIGURE 8



G. Laser-beam instrument

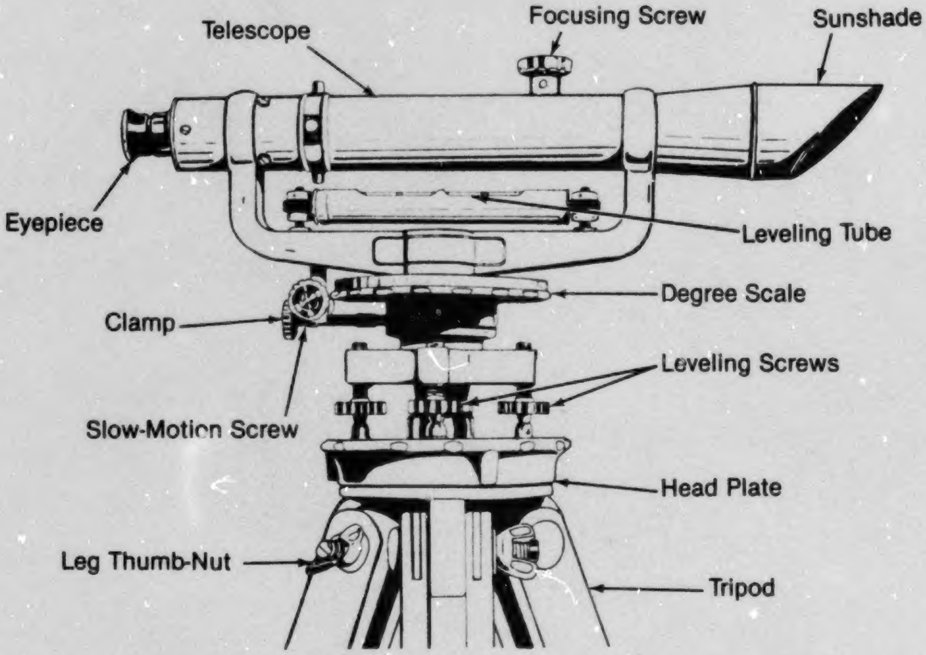
FIGURE 9



INFORMATION SHEET

V. Parts of a builder's level (Figure 10)

FIGURE 10


Telescope
Focusing Screw
Sunshade
Eyepiece
Leveling Tube
Degree Scale
Clamp
Leveling Screws
Slow-Motion Screw
Head Plate
Leg Thumb-Nut
Tripod

VI. Uses of a transit

A. Measuring horizontal angles

B. Measuring vertical angles

C. Measuring elevations

D. Measuring horizontal and vertical distances

E. Determining magnetic bearings

F. Laying out boundaries and building lines

G. Establishing elevations and grades

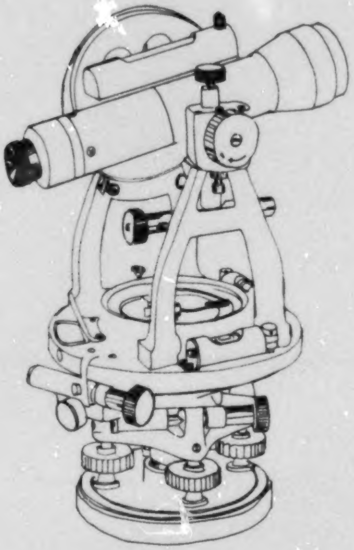
(NOTE: A builder's level is the preferred instrument for establishing grades, but a transit can be used if a level is not available.)

INFORMATION SHEET

VII. Types of transits (Figures 11-14)

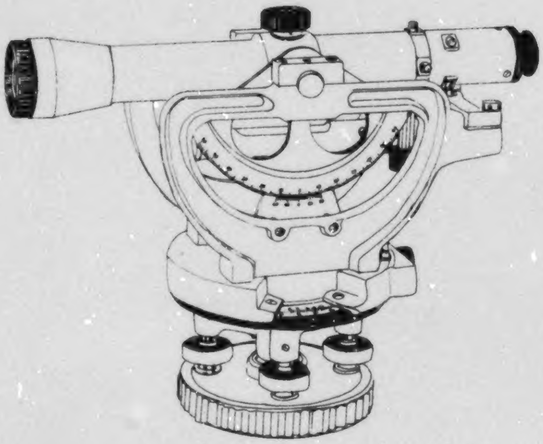
A. Engineer's transit

FIGURE 11



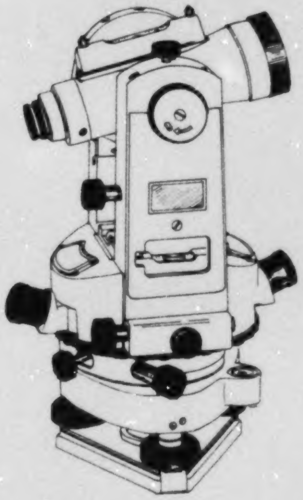
B. Combination level-transit

FIGURE 12



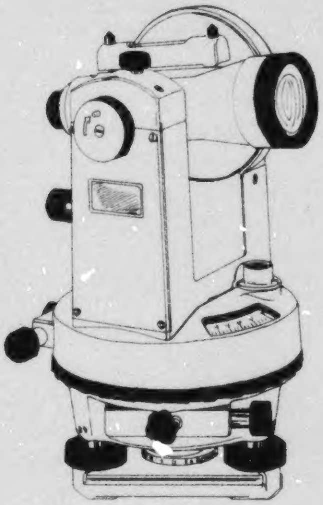
C. Optical transit

FIGURE 13



D. Optical plummet transit

FIGURE 14



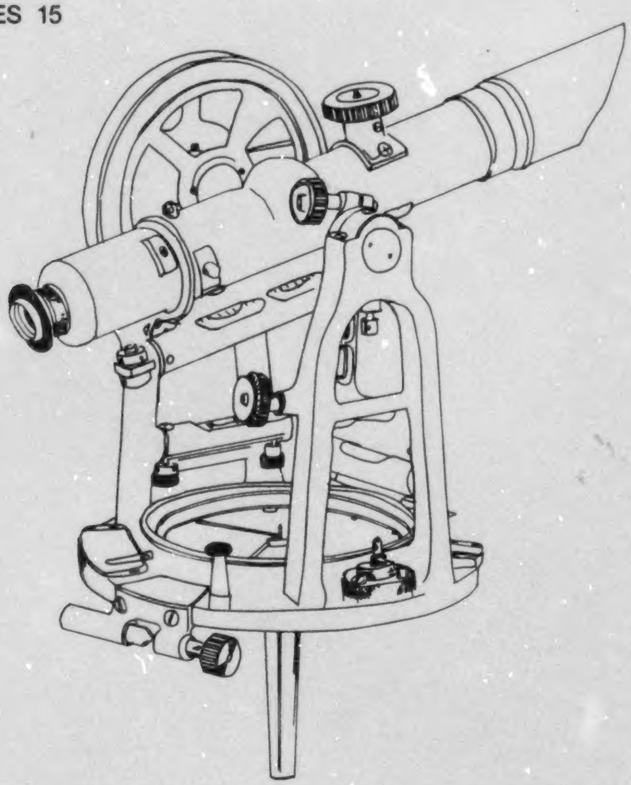
Figures 11-14 used with permission of The Lietz Company, Overland Park, Kansas.

INFORMATION SHEET

VIII. Major components of an engineer's transit (Figures 15-17)

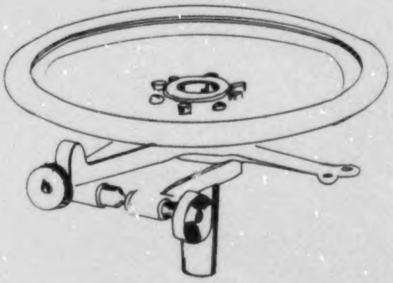
A. Alidade

FIGURES 15



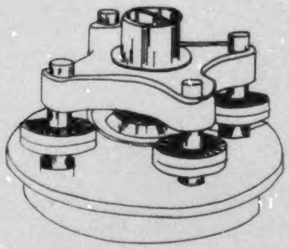
B. Horizontal circle

FIGURE 16



C. Leveling head

FIGURE 17

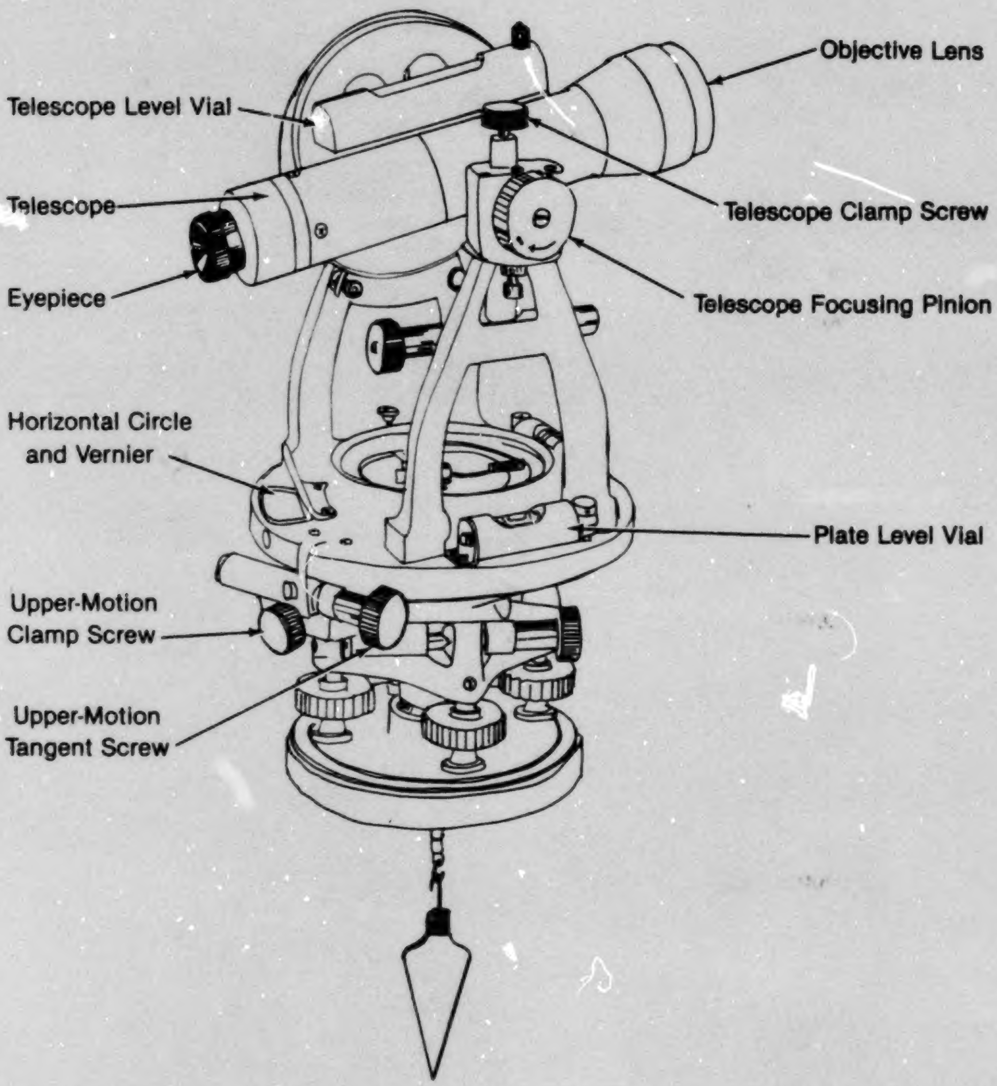


INFORMATION SHEET

IX. Parts of an engineer's transit (Figures 18 and 19)

View A

FIGURE 18

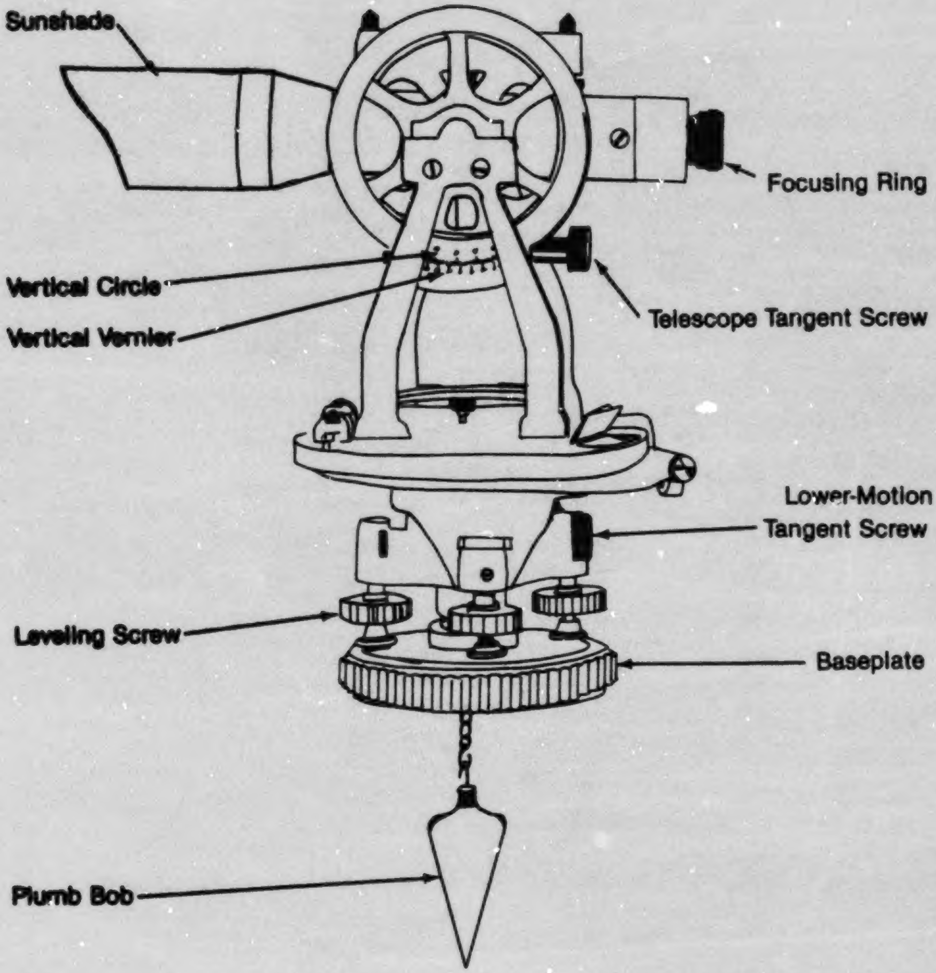

Objective Lens
Telescope Level Vial
Telescope
Telescope Clamp Screw
Eyepiece
Telescope Focusing Pinion
Horizontal Circle and Vernier
Plate Level Vial
Upper-Motion Clamp Screw
Upper-Motion Tangent Screw

Adapted with permission of The Lietz Company, Overland Park, Kansas.

INFORMATION SHEET

View B

FIGURE 19


Sunshade
Focusing Ring
Vertical Circle
Vertical Vernier
Telescope Tangent Screw
Lower-Motion Tangent Screw
Leveling Screw
Baseplate
Plumb Bob

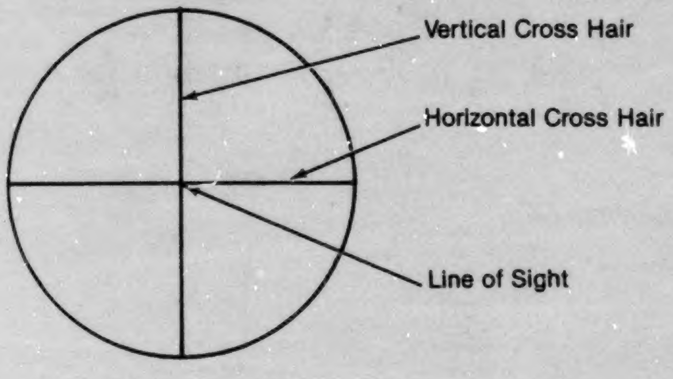
Adapted with permission of The Lietz Company, Overland Park, Kansas.

INFORMATION SHEET

X. Vertical and horizontal cross hairs and line of sight on a leveling instrument (Figure 20)

(NOTE: Vertical cross hairs indicate direction. Horizontal cross hairs indicate the flat plane. The point where the vertical and horizontal cross hairs meet indicates line of sight.)

FIGURE 20



XI. Rules for proper care of leveling instruments

(NOTE: Leveling instruments are sensitive instruments that require extremely careful treatment.)

A. Keep instrument in carrying case when not in use

B. Protect instrument from shock and vibration when transporting

C. Remove instrument from carrying case by lifting the level bar

(NOTE: Never grasp the telescope barrel while removing instrument from the carrying case.)

D. Never force screws or other moving parts of the instrument

E. Place lens and tripod caps in carrying case after removing them from instrument

F. Do not remove lenses

G. Clean lenses with soft tissue only

H. Always use sunshade regardless of weather

I. Loosen leveling screws before returning instrument to carrying case

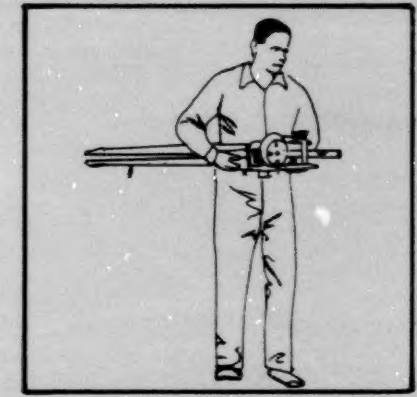
INFORMATION SHEET

J. Carry tripod under your arm with the instrument in front of you (Figure 21)

(NOTE: Never carry tripod over your shoulder when instrument is attached.)

EXAMPLE:

FIGURE 21



XII. Parts of a leveling rod (Figures 22 and 23)

FIGURE 22: Front view

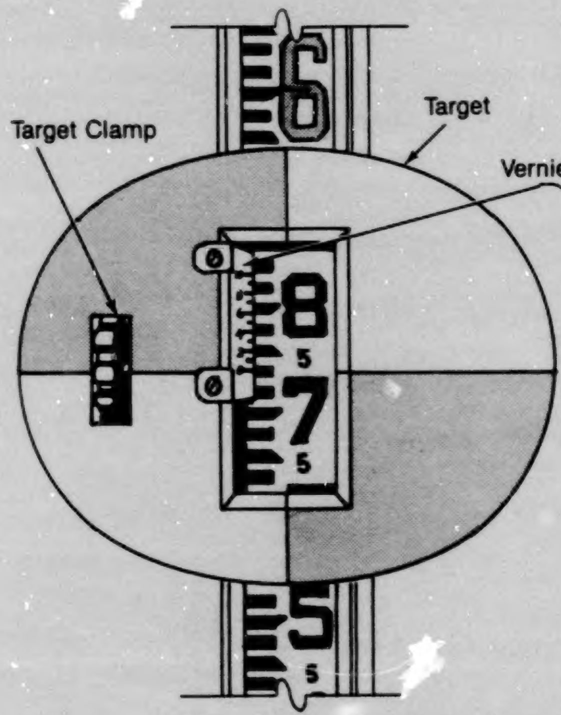
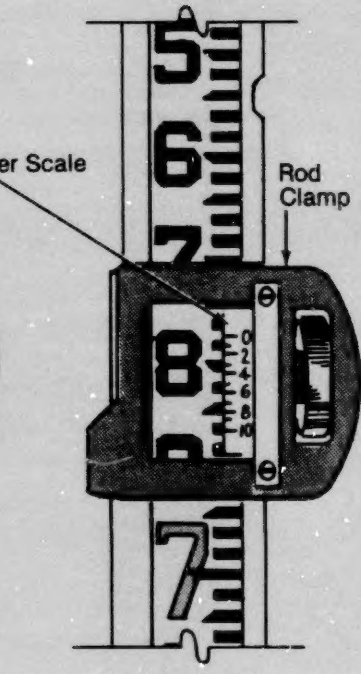

6
Target Clamp
Target
Vernier Scale
8
5
7
5
5
5

FIGURE 23: Back view


5
6
Rod Clamp
8
0
2
4
6
8
10
7

INFORMATION SHEET

XIII. Uses of parts of a leveling rod

A. Target — Helps make measurements within a certain range on leveling rod; holds vernier scale

(NOTE: The target is usually a red and white disk that slides up and down on the rod.)

B. Target clamp — Holds target in place

C. Rod clamp — Holds rod open when extended

D. Vernier scale — Enables reading to the nearest thousandth of a foot or nearest sixty-fourth of a foot

XIV. Commonly used direct-reading rods

(NOTE: There are many types of leveling rods, but the two types of direct-reading rods described below are the ones most commonly used.)

A. Rod graduated in eighths of an inch — Marks indicate feet, inches, and eighths of an inch; each line and each space is one-eighth of an inch thick (See Figure 24)

B. Rod graduated in hundredths of a foot — Marks indicate feet, tenths of a foot, and hundredths of a foot; each line and each space is one hundredths of a foot thick (Figure 25)

EXAMPLES:

FIGURE 24: Rod graduated in eighths of an inch

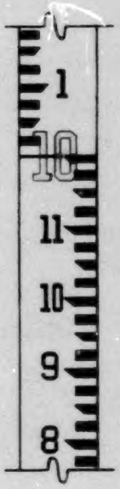
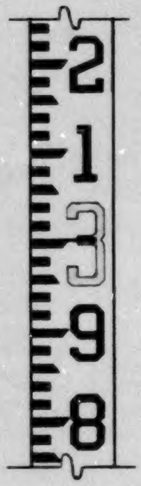


FIGURE 25: Rod graduated in hundredths of a foot



INFORMATION SHEET

XV. Reading a direct-reading rod (Figures 26 and 27)

A. Marks at large red numbers indicate full feet

(NOTE: Some rods also have small running-foot numbers spaced at intervals between the large red full-foot numbers.)

B. Marks at small black numbers indicate full inches or tenths of a foot (0.1 foot), depending on rod used

C. Black marks and spaces between full-inch or full-tenth-of-a-foot marks indicate eighths of an inch or hundredths of a foot (0.01 foot), depending on rod used

EXAMPLES:

FIGURE 26: Reading a rod graduated in eighths of an inch

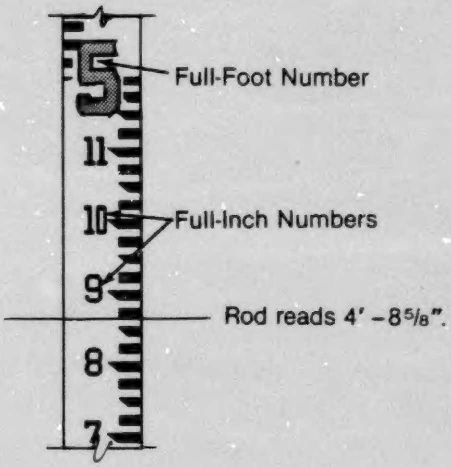
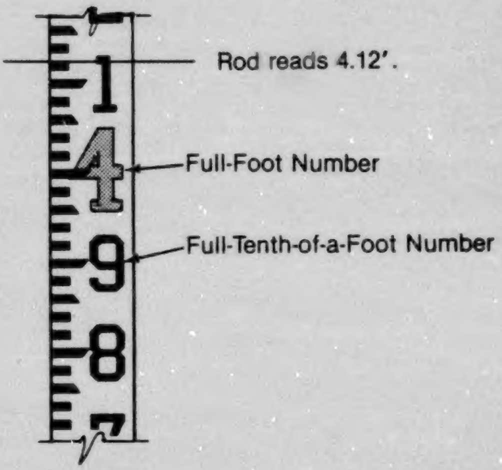

5
Full-Foot Number
11
10
Full-Inch Numbers
9
Rod reads 4′ -8⁵/₈″.
8
7

FIGURE 27: Reading a rod graduated in hundredths of a foot


Rod reads 4.12′.
1
4
Full-Foot Number
9
Full-Tenth-of-a-Foot Number
8
7

XVI. Hand signals used by the instrument person to guide the rod person (Figures 28-37)

A. Move in this direction

FIGURE 28

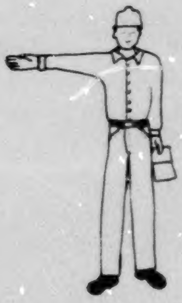
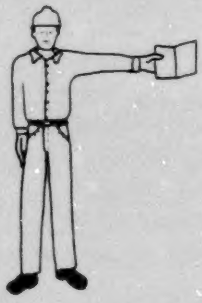


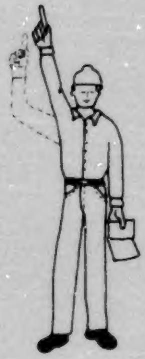
FIGURE 29



INFORMATION SHEET

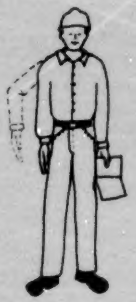
B. Move up

FIGURE 30



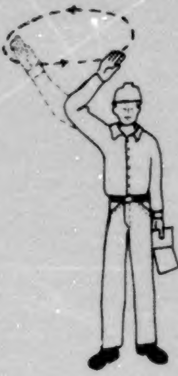
C. Move down

FIGURE 31



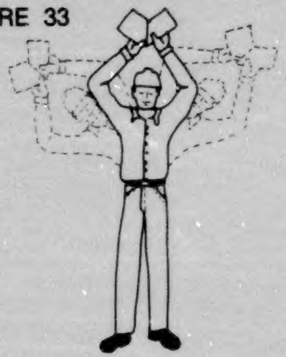
D. Turning point

FIGURE 32



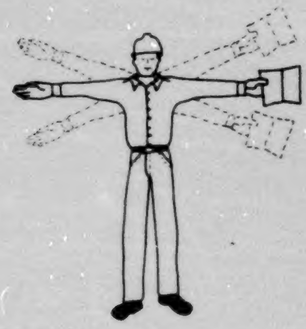
E. Wave rod from side to side

FIGURE 33



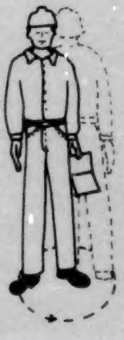
F. Observation completed; move on; understand

FIGURE 34



G. Wrong face; cleck clamp; rod upside down

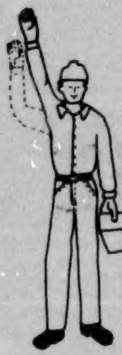
FIGURE 35



INFORMATION SHEET

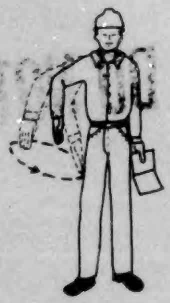
H. Use long rod

FIGURE 36



I. Come in

FIGURE 37



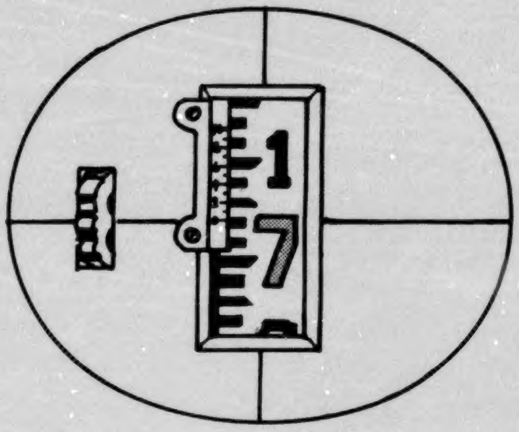
BUILDER'S LEVEL AND TRANSIT
UNIT I

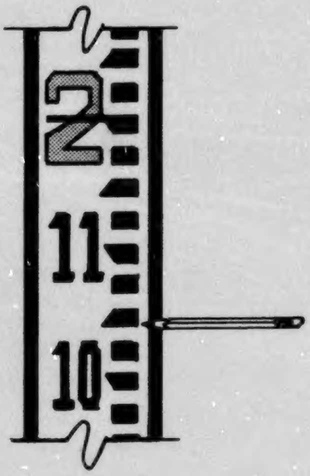
ASSIGNMENT SHEET #1 — READ LEVELING RODS

NAME ______________________________ SCORE ______________

The leveling rod is a very important carpentry tool that is used with a leveling instrument to read elevations. With practice, the carpenter can become skilled at reading elevations and lines quickly and accurately.

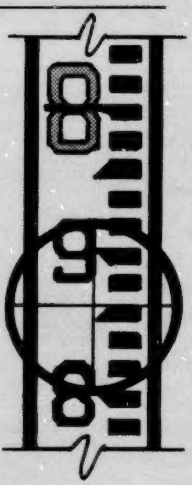
Read each of the following illustrations to the nearest eighth of an inch or hundredth of a foot, depending on the type of rod illustrated. Write the correct answers in the blanks.

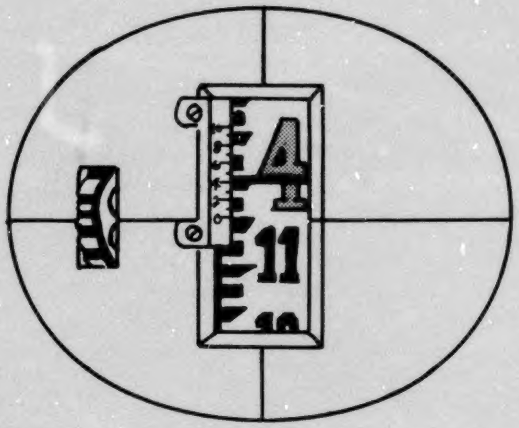




A. ______________________

B. ______________________





C. ______________________

D. ______________________

BUILDER'S LEVEL AND TRANSIT
UNIT I

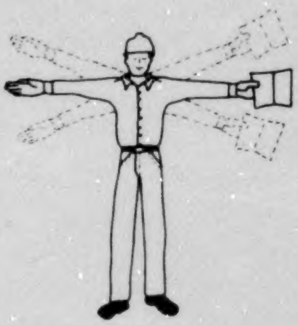
ASSIGNMENT SHEET #2 — DISTINGUISH AMONG HAND SIGNALS USED BY THE INSTRUMENT PERSON TO GUIDE THE ROD PERSON

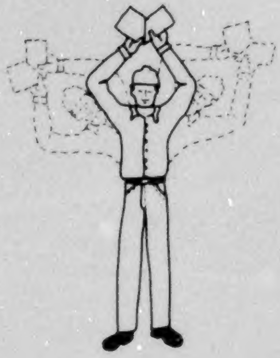
NAME ______________________________ SCORE ______________

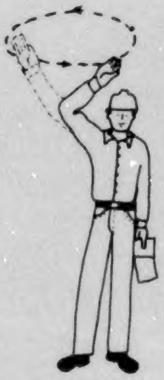
Knowing hand signals will save you many steps and much time when you are operating a leveling instrument.

Distinguish among the following hand signals used by the instrument person by writing an "X" in the blank under each correct illustration.

A. Wave rod from side to side

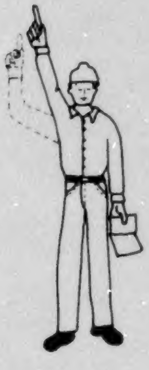


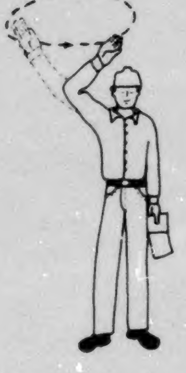


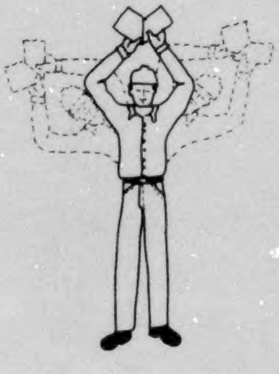


1. ______________ 2. ______________ 3. ______________

B. Move up



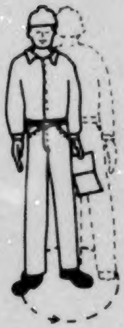


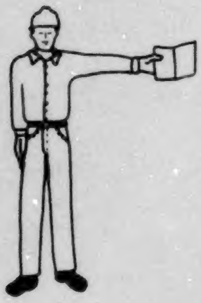


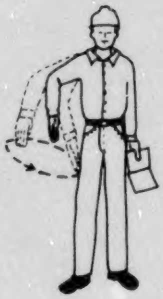
1. ______________ 2. ______________ 3. ______________

ASSIGNMENT SHEET #2

C. Come in

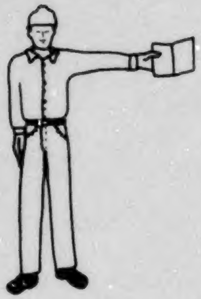


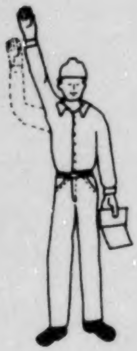


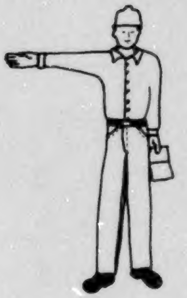


1. ____________________ 2. ____________________ 3. ____________________

D. Move in this direction

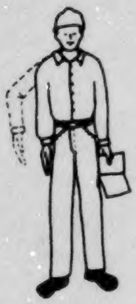


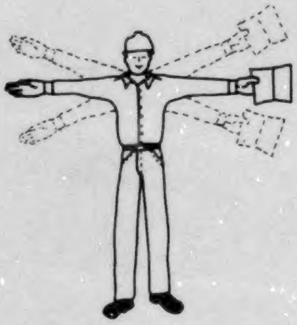


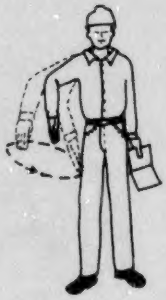


1. ____________________ 2. ____________________ 3. ____________________

E. Observation completed



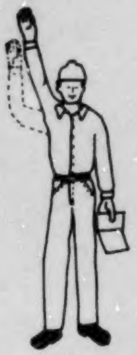


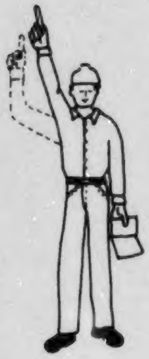


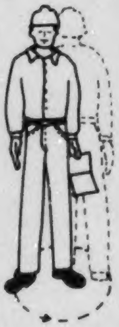
1. ____________________ 2. ____________________ 3. ____________________

ASSIGNMENT SHEET #2

F. Rod upside down

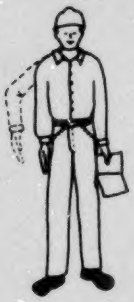


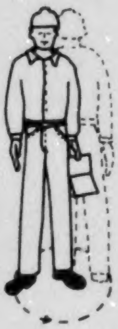


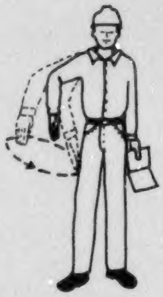


1. ____________ 2. ____________ 3. ____________

G. Move down

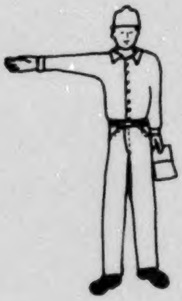


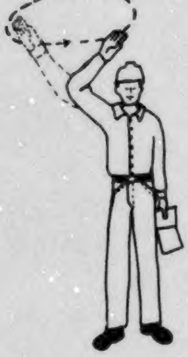


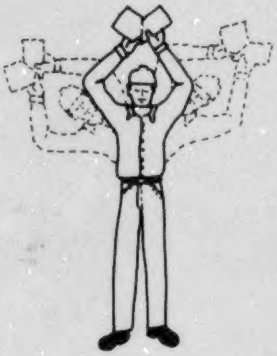


1. ____________ 2. ____________ 3. ____________

H. Turning point



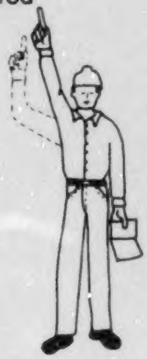


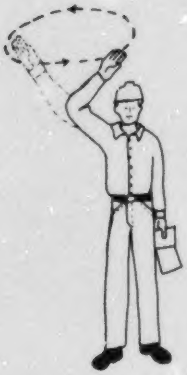


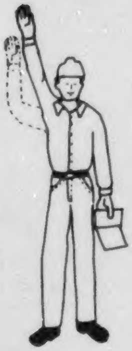
1. ____________ 2. ____________ 3. ____________

ASSIGNMENT SHEET #2

I. Use long rod

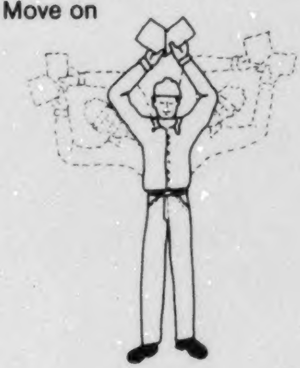


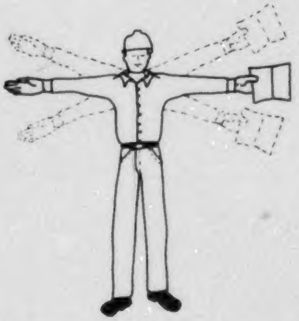


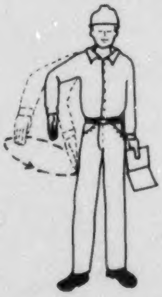


1. ______________ 2. ______________ 3. ______________

J. Move on

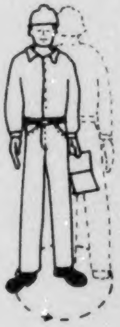


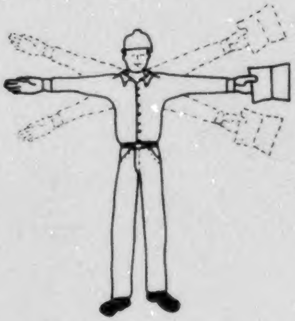


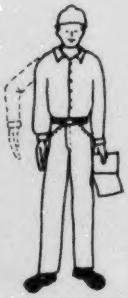


1. ______________ 2. ______________ 3. ______________

K. Wrong face







1. ______________ 2. ______________ 3. ______________

BUILDER'S LEVEL AND TRANSIT
UNIT I

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

A. 7.04'
B. $1' - 10\frac{3}{8}''$
C. 7.86'
D. $3' - 11\frac{1}{2}''$

Assignment Sheet #2

A. 2
B. 1
C. 3
D. 1,3
E. 2
F. 3
G. 1
H. 2
I. 3
J. 2
K. 1

BUILDER'S LEVEL AND TRANSIT
UNIT I

JOB SHEET #1 — SET UP AND ADJUST A BUILDER'S LEVEL

I. Equipment

A. Builder's level in carrying case

B. Tripod

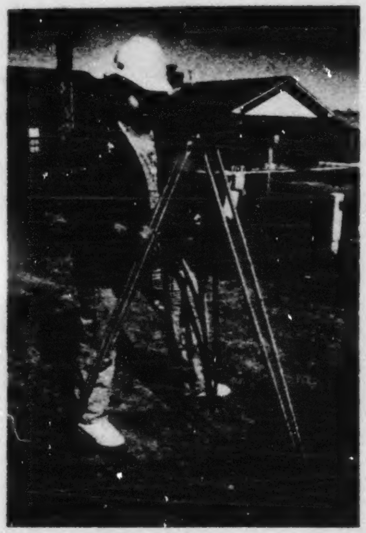
II. Procedure

A. Set leg shoes of the two nearest tripod legs in ground about 3 feet apart (See Figure 38)

B. Swing third leg out to form a triangle, placing legs on ground so that head plate is nearly level (Figure 38)

(NOTE: If the ground is not level, you may have to change position of tripod in order to keep head plate level. Always place two tripod legs on downhill or uneven side.)

FIGURE 38



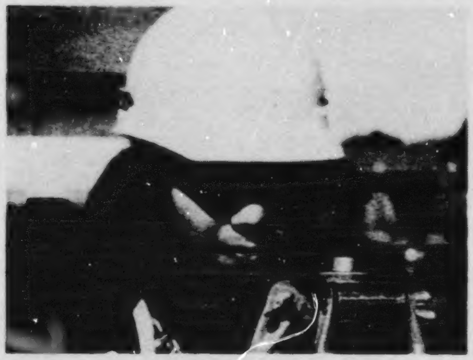
C. Tighten leg thumb-nuts

D. Remove head-plate cap and place cap in carrying case

JOB SHEET #1

E. Check head plate to assure that it is level (Figure 39)

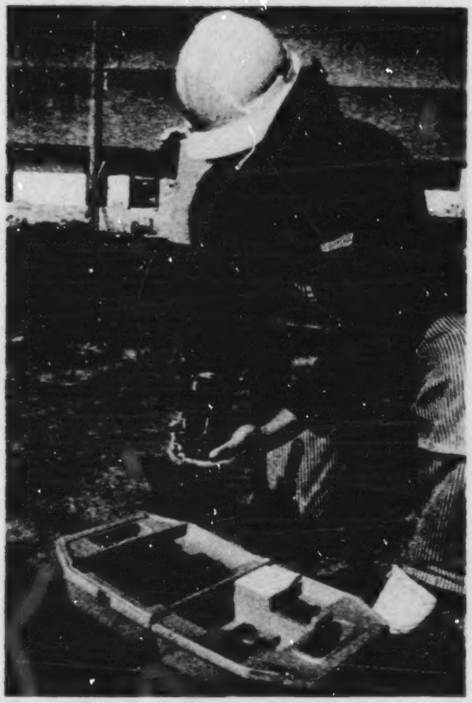
FIGURE 39



F. Remove instrument from carrying case by lifting level bar (Figure 40)

(NOTE: Never grasp the telescope barrel while removing instrument from carrying case.)

FIGURE 40

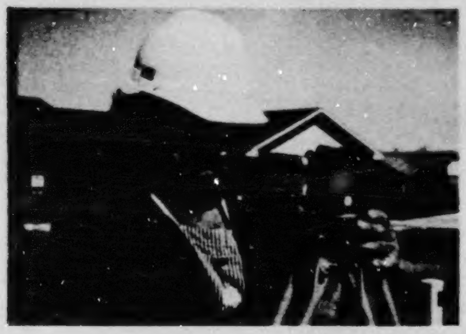


JOB SHEET #1

G. Attach instrument to tripod (Figure 41)

(NOTE: Keep a firm grip on instrument until it is securely in position on tripod.)

FIGURE 41



H. Remove dust cap from lens and place cap in carrying case

(NOTE: Between uses, keep the dust cap in place to protect the lens from dust or scratches.)

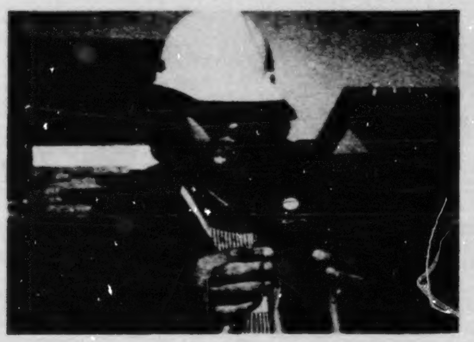
I. Attach sunshade to instrument if sunshade is not a permanent attachment

J. Align telescope barrel directly over one pair of leveling screws

(NOTE: The leveling screws will be used as the name indicates: to level the instrument.)

K. Rotate screws under leveling head by moving your thumbs in opposite directions until bubble is centered in leveling tube (Figure 42)

FIGURE 42

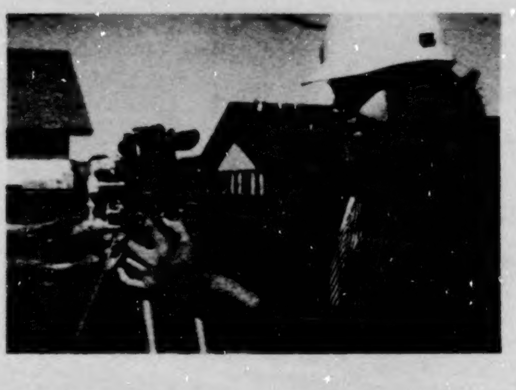


JOB SHEET #1

L. Turn instrument clockwise 90 degrees to align barrel over other pair of leveling screws

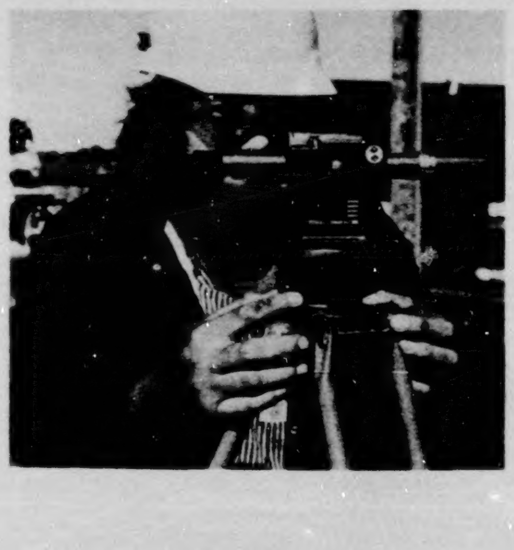
M. Rotate screws under leveling head by moving your thumbs in opposite directions until bubble is centered in leveling tube (Figure 43)

FIGURE 43



N. Turn instrument clockwise 90 degrees to bring it parallel with first pair of leveling screws; center bubble again (Figure 44)

FIGURE 44



O. Turn instrument clockwise 90 degrees to bring it parallel with second pair of leveling screws; center bubble again

(NOTE: Bubble should stay in center regardless of direction the telescope is pointing. If bubble does not stay in center, instrument is out of level and should be adjusted by competent personnel.)

JOB SHEET #1

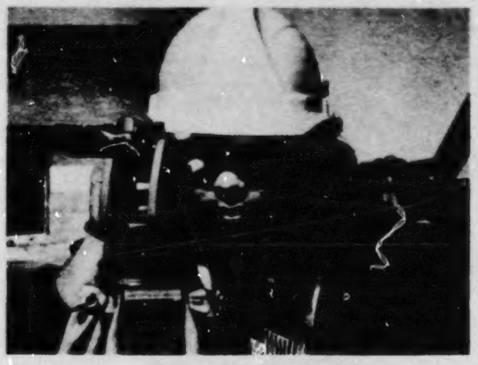
P. Avoid touching tripod after instrument is level

(NOTE: If instrument creeps off level or is bumped during use, stop and reset tripod, relevel instrument, and start again from last known good bench mark.)

Q. Turn eyepiece focusing ring until cross hairs appear clear and sharp (Figure 45)

(NOTE: The target may not be in focus.)

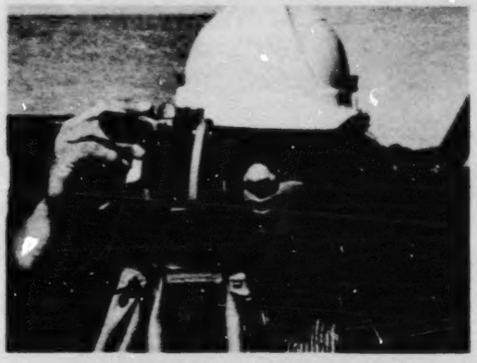
FIGURE 45



R. Rotate focusing screw to bring target into sharp focus (Figure 46)

(NOTE: When cross hairs and target are in sharp focus, you should be able to read a rod accurately. Always tie level shots back to starting bench mark to check for error in rod shots or in field notes.)

FIGURE 46



S. Replace lens dust-cap, disassemble instrument from tripod, and store instrument in carrying case; replace head-plate cap on tripod

T. Store carrying case and tripod

BUILDER'S LEVEL AND TRANSIT
UNIT I

JOB SHEET #2 — USE A BUILDER'S LEVEL TO CHECK FOOTING ELEVATIONS

I. Tools and equipment

   A. Builder's level in carrying case

   B. Tripod

   C. Leveling rod

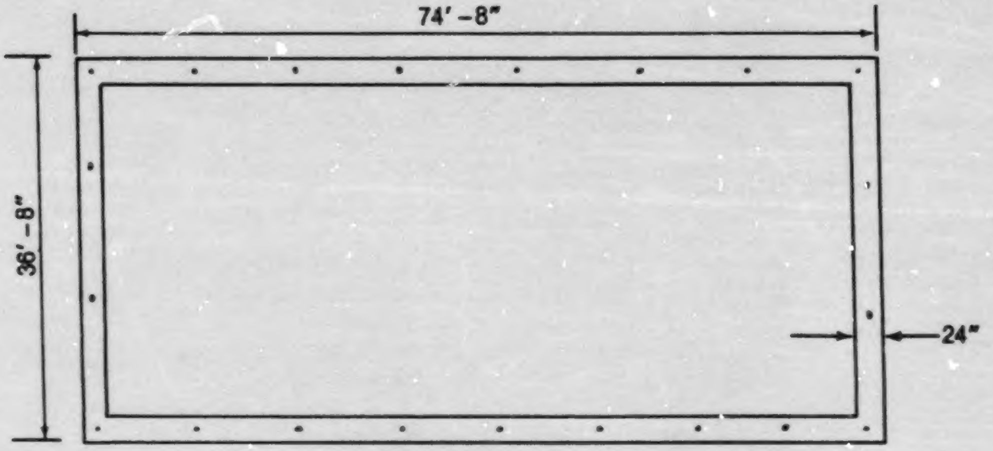
   D. Keel

   E. Specifications furnished by instructor

   F. Drawing (Figure 47)

   (NOTE: Footing elevations in this job sheet are 5′ – 1 1/2″. Dots on the drawing indicate checkpoints, which are located at each corner and roughly every 10 to 12 feet completely around footing. The instructor may prefer to assign other practice elevations and to have the job performed on a shop floor or on a parking lot rather than on actual footings.)

FIGURE 47



JOB SHEET #2

II. Procedure

A. Check drawing (See Figure 47) to see which elevations are to be determined, and establish setup for builder's level

(NOTE: Be certain that the locations of all the elevations can be seen through the builder's level.)

B. Set up and adjust builder's level

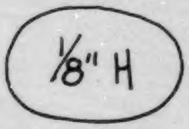
(NOTE: See Job Sheet #1.)

C. While assistant holds leveling rod at first checkpoint, sight through the builder's level and take a reading on leveling rod

D. Have assistant use keel to record on foundation any difference between reading and correct footing elevation, marking *H* for high or *L* for low

(NOTE: Footing elevation is 5' – 1½". Reading is 5' – 1⅜". Footing elevation is ⅛ inch higher than correct elevation. Record ⅛" *H* on top of footing. See Figure 48.)

FIGURE 48



E. Have assistant move leveling rod to next checkpoint

F. Adjust builder's level to focus on next checkpoint

G. Sight through the builder's level at the leveling rod and take a reading

H. Have assistant record on footing any difference between reading and correct footing elevation, marking *H* for high or *L* for low

I. Repeat steps E through H for each checkpoint around footing

J. Check with instructor to see whether footing elevations are all within the ± specifications

K. Disassemble builder's level from tripod and store in carrying case; put away other tools and equipment

BUILDER'S LEVEL AND TRANSIT
UNIT I

JOB SHEET #3 — USE A BUILDER'S LEVEL TO PERFORM DIFFERENTIAL LEVELING

I. Tools and equipment

   A. Builder's level

   B. Tripod

   C. Leveling rod

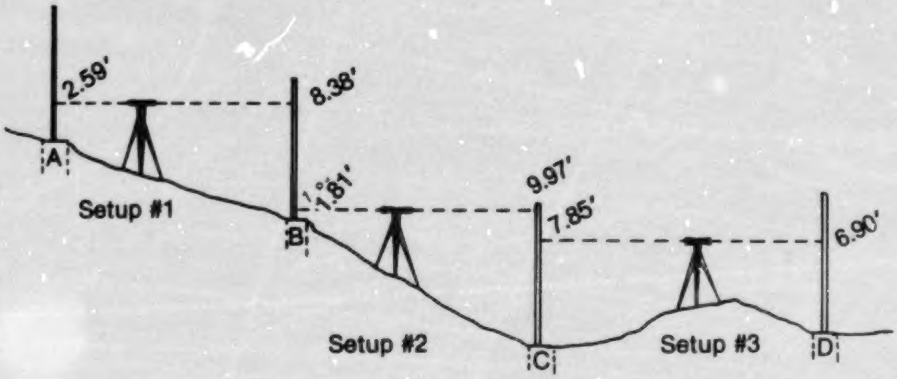
   D. Field book

   E. Pencil

   F. Drawing (Figure 49)

   (NOTE: The procedure described in this job sheet is based on the elevations shown in the drawing below. The instructor may prefer to assign other practice elevations.)

FIGURE 49



II. Procedure

   A. Determine difference in elevation between points A and B

      1. Check drawing (See Figure 49) to see which elevations are to be determined, and establish setup #1 for builder's level

      (NOTE: Do not set up more than 150 to 200 feet from each point, but be certain that points A and B can both be seen through the builder's level.)

JOB SHEET #3

2. Set up and adjust builder's level at setup #1

   (NOTE: See Job Sheet #1.)

3. While assistant holds leveling rod at point A, sight through the builder's level and take a reading on leveling rod

4. Record reading in field book

   (NOTE: Line of sight at point A is 2.59 feet from setup #1.)

5. Have assistant move leveling rod to point B

6. Adjust builder's level to focus on point B

7. Sight through builder's level and take a reading on leveling rod

8. Record reading in field book

   (NOTE: Line of sight at point B is 8.38 feet from setup #1.)

9. Record plus and minus readings in field book (Figure 50)

   (NOTE: Plus sight is the rod reading from the point to the line of sight. Minus sight is the rod reading from the line of sight to the point.)

FIGURE 50

Setup	+ Rod	H I	− Rod	Elevation
1	2.59			
			8.38	

B. Determine difference in elevation between points B and C

1. Check drawing (See Figure 49) to see which elevations are to be determined, and establish setup #2 for builder's level

   (NOTE: Do not set up more than 150 to 200 feet from each point, but be certain that points B and C can both be seen through the builder's level.)

JOB SHEET #3

2. Set up and adjust builder's level at setup #2

   (NOTE: See Job Sheet #1.)

3. While assistant holds leveling rod at point B, sight through the builder's level and take a reading on leveling rod

4. Record reading in field book

   (NOTE: Line of sight at point B is 1.81 feet from setup #2.)

5. Have assistant move leveling rod to point C

6. Adjust builder's level to focus on point C

7. Sight through builder's level and take a reading on leveling rod

8. Record reading in field book

   (NOTE: Line of sight at point C is 9.97 feet from setup #2.)

9. Record plus and minus readings in field book (Figure 51)

FIGURE 51

Setup	+ Rod	H I	− Rod	Elevation
1	2.59			
			8.38	
2	1.81			
			9.97	

C. Determine difference in elevation between points C and D

1. Check drawing (See Figure 49) to see which elevations are to be determined, and establish setup #3 for builder's level

   (NOTE: Do not set up more than 150 to 200 feet from each point, but be certain that points C and D can both be seen through the builder's level.)

2. Set up and adjust builder's level at setup #3

   (NOTE: See Job Sheet #1.)

3. While assistant holds leveling rod at point C, sight through builder's level and take a reading on leveling rod

JOB SHEET #3

4. Record reading in field book

   (NOTE: Line of sight at point C is 7.85 feet from setup #3.)

5. Have assistant move leveling rod to point D

6. Adjust builder's level to focus on point D

7. Sight through builder's level and take a reading on leveling rod

8. Record reading in field book

   (NOTE: Line of sight at point D is 6.90 feet from setup #3.)

9. Record plus and minus reading in field book (Figure 52)

FIGURE 52

Setup	+ Rod	H I	− Rod	Elevation
1	2.59			
			8.38	
2	1.81			
			9.97	
3	7.85			
			6.90	

D. Total plus sight column and minus sight column in field book (Figure 53)

FIGURE 53

Setup	+ Rod	H I	− Rod	Elevation
1	2.59			
			8.38	
2	1.81			
			9.97	
3	7.85			
			6.90	
Sum	12.25		25.25	

JOB SHEET #3

E. Subtract smaller number from larger to find the difference in elevations

(NOTE: Subtracting 12.25 feet from 25.25 feet, leaves 13.00 feet. Point D is 13.00 feet lower than point A.)

F. Disassemble builder's level from tripod, and store instrument in carrying case; put away carrying case, tripod, and other tools and equipment

BUILDER'S LEVEL AND TRANSIT
UNIT I

JOB SHEET #4 — CONNECT PLUMB BOB TO TRANSIT

I. Equipment

- A. Transit in carrying case
- B. Tripod
- C. Plumb bob with cord

II. Procedure

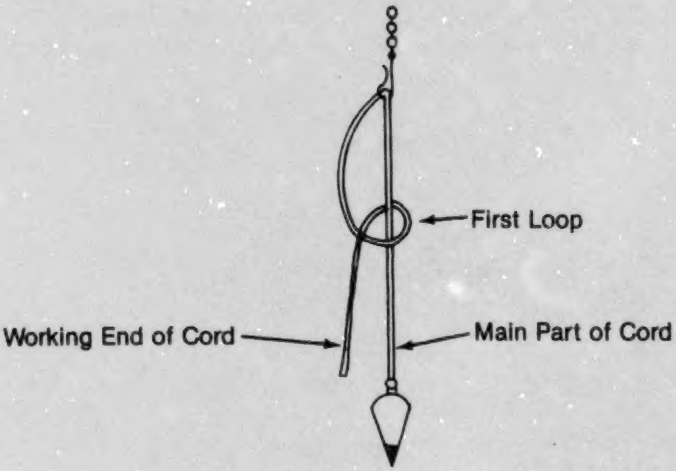
- A. Set leg shoes of the two nearest tripod legs in ground about 3 feet apart
- B. Swing third leg out to form a triangle, placing legs on ground so that head plate is nearly level

  (NOTE: If ground is not level, you may have to change position of tripod in order to keep head plate level. Always place two legs on downhill or uneven side.)
- C. Tighten leg thumb-nuts
- D. Check head plate to assure that it is level
- E. Remove transit from carrying case by lifting its baseplate

  (NOTE: Never grasp the telescope barrel while removing the transit from carrying case.)
- F. Still holding transit by its baseplate, attach transit to tripod
- G. Loop plumb-bob cord over hook on transit
- H. Knot cord
  - 1. Make first loop in cord (See Figure 54)
    - a. Bring working end of cord in front of main part of cord
    - b. Take working end behind main part of cord
    - c. Draw working end through space between working end and main part of cord

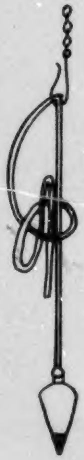
JOB SHEET #4

FIGURE 54


First Loop
Working End of Cord
Main Part of Cord

2. Make a second loop in working end of cord (See Figure 55)
3. Pass second loop up through bottom of first loop (Figure 55)

FIGURE 55

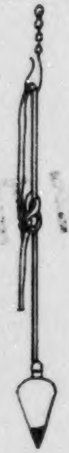


JOB SHEET #4

4. Tighten knot (Figure 56)

(NOTE: This knot secures the plumb bob without affecting the true perpendicular. The knot can be easily untied to raise or lower the plumb bob.)

FIGURE 56



I. Disassemble transit from tripod, and store instrument in carrying case

J. Put away carrying case, tripod, and plumb bob

BUILDER'S LEVEL AND TRANSIT
UNIT I

JOB SHEET #5 — SET UP AND ADJUST A COMBINATION LEVEL-TRANSIT

I. Tools and equipment

A. Combination level-transit in carrying case

B. Tripod

C. Plumb bob with cord

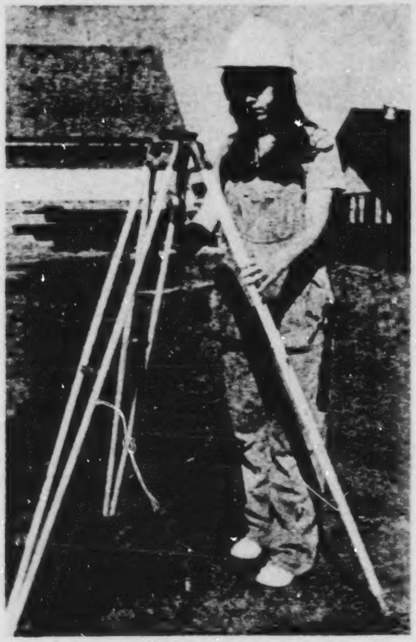
D. Stake driven in ground and marked with established point (provided by instructor)

II. Procedure

A. Over stake at point established by instructor, set leg shoes of the two nearest tripod legs in ground about 3 feet apart; swing third leg out to form a triangle, placing legs on ground so that head plate is nearly level (Figure 57)

(NOTE: If the ground is not level, you may have to change position of tripod in order to keep head plate level. Always place two tripod legs on downhill or uneven side.)

FIGURE 57

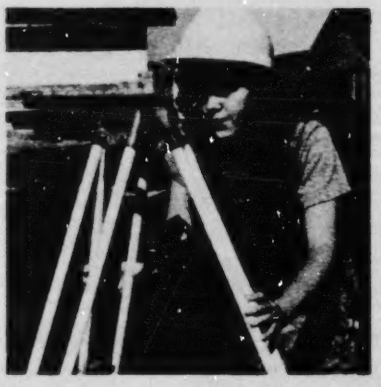


JOB SHEET #5

B. Tighten leg thumb-nuts

C. Check head plate to assure that it is level (Figure 58)

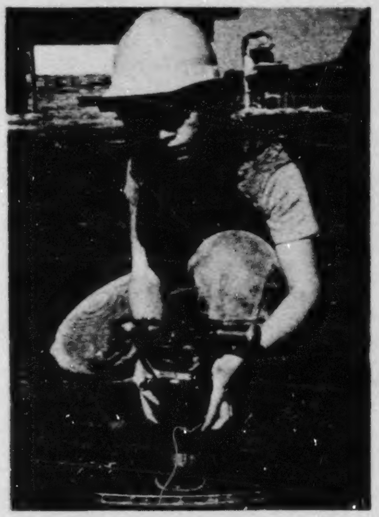
FIGURE 58



D. Remove instrument from carrying case by lifting its baseplate (Figure 59)

(NOTE: Never grasp the telescope barrel while removing the instrument from carrying case.)

FIGURE 59



E. Still holding instrument by its baseplate, attach instrument to tripod

F. Remove dust cap from lens and place cap in carrying case

JOB SHEET #5

G. Attach sunshade to instrument

H. Attach plumb bob to instrument

(NOTE: Follow procedure in steps F and G in Job Sheet #4.)

I. Center instrument on footplate

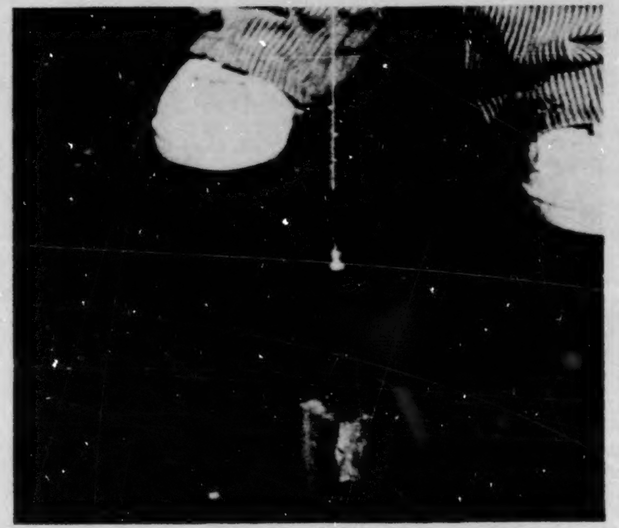
J. Bring plumb bob to a position within 2 or 3 inches of established point on stake, moving tripod and instrument together (Figure 60)

FIGURE 60

K. Firmly set tripod legs into ground

L. Raise or lower plumb bob until it hangs about 1 inch above established point on stake (Figure 61)

FIGURE 61

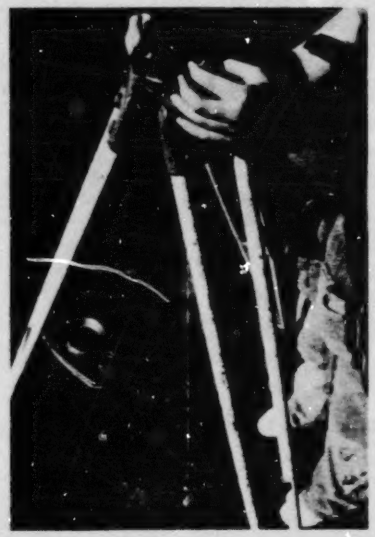


JOB SHEET #5

M. Moving tripod legs from side to side, adjust legs as required to bring plumb bob within 1/4 inch of established point on stake

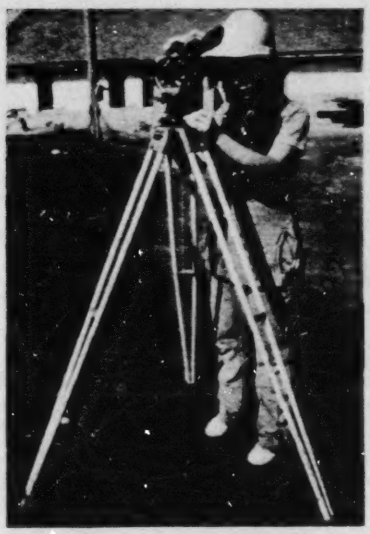
N. Loosen one pair of leveling screws (Figure 62)

FIGURE 62



O. Slide leveling head until plumb bob and the center of the small ellipse in which plumb bob swings are exactly over established point on stake (Figure 63)

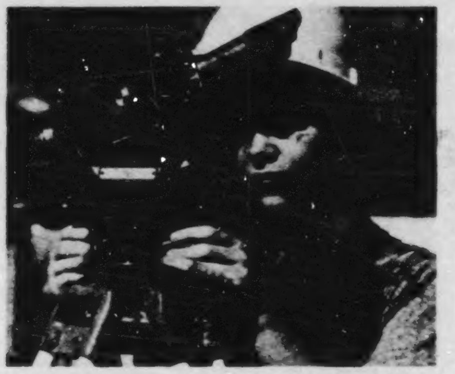
FIGURE 63



JOB SHEET #5

P. Tighten leveling screws firmly (Figure 64)

FIGURE 64



Q. Level instrument

(NOTE: Follow procedure as for builder's level in steps J through R of Job Sheet #1.)

R. Replace lens dust-cap, disassemble instrument from tripod, and store instrument in carrying case

S. Store carrying case, tripod, and other tools and equipment

BUILDER'S LEVEL AND TRANSIT
UNIT I

JOB SHEET #6 — USE A COMBINATION LEVEL-TRANSIT TO LOCATE BUILDING-LINE POINTS ON BATTER BOARDS

I. Tools and equipment

A. Combination level-transit in carrying case

B. Tripod

C. Plumb bob with cord

D. 200-foot tape

E. Claw hammer

F. Stakes

G. Sledgehammer

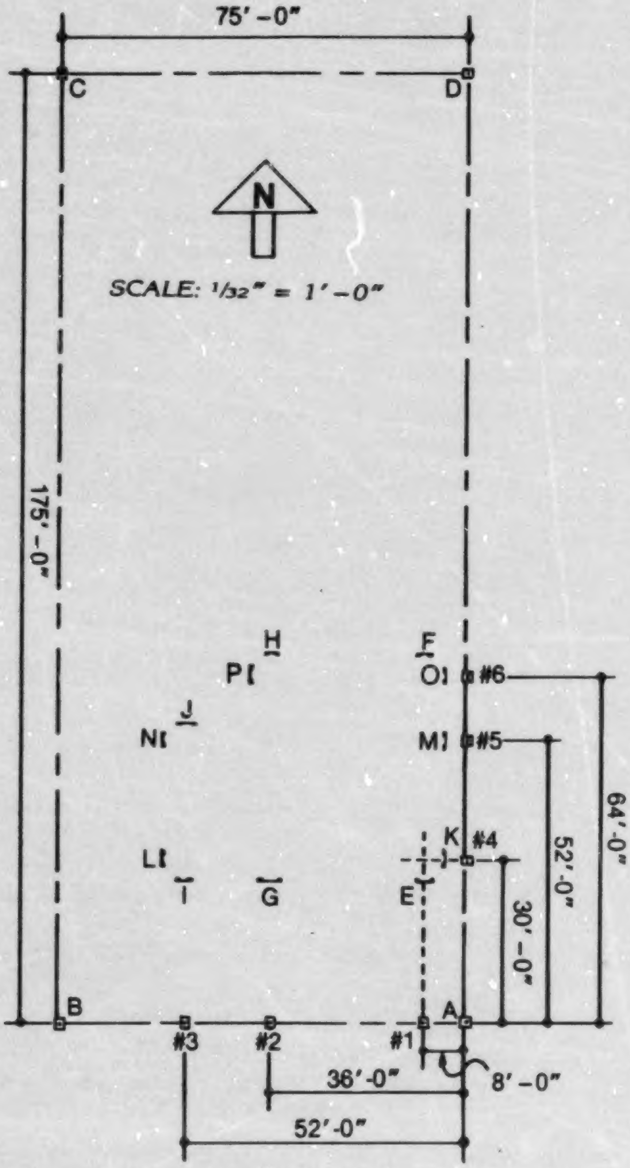
H. Surveyor's tacks

I. Nails

J. Batter-board layout (Figure 65)

(NOTE: The angle formed by lines AB and AD is a 90-degree angle.)

FIGURE 65


75'-0"
C
D
N
SCALE: 1/32" = 1'-0"
175'-0"
H
F
P
O
#6
J
N
M
#5
64'-0"
52'-0"
K
#4
L
I
G
E
30'-0"
B
A
#3
#2
#1
36'-0"
8'-0"
52'-0"

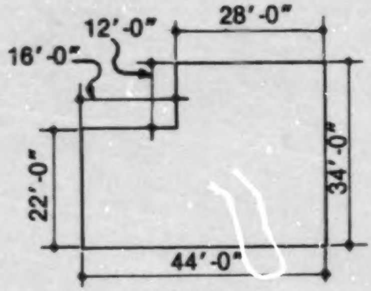
JOB SHEET #6

II. Procedure

A. Study batter-board layout (See Figure 65) and building dimensions (Figure 66)

(NOTE: The instructor has established property-line points A, B, C, and D and has marked these points on lot with stakes and surveyor's tacks; instructor has also determined the angle formed by lines AB and AD is a 90-degree angle. The instructor has also set batter boards for a building on a 75′ –0″ × 175′ –0″ lot. The building is set back 30 feet from south boundary and 8 feet from east boundary.)

FIGURE 66



B. Check tacks on property-line stakes to make certain that line AB is straight

1. Set up and adjust level-transit over point A

   (NOTE: See Job Sheet #5.)

2. Loosen vertical-motion clamp screws
3. Tilt instrument downward, and sight through telescope at tack on point B
4. Focus instrument on tack on stake at point B to determine whether line AB is straight

   (NOTE: If line AB is not straight, notify the instructor.)

5. Tighten vertical-motion clamp screws

   (NOTE: Do not overtighten screws.)

C. Check tacks on property-line stakes to make certain that line AD is straight

1. With instrument still focused on point B, set the 360-degree scale at zero

JOB SHEET #6

2. Loosen horizontal-motion clamp screws, and turn instrument clockwise until the scale indicates that a 90-degree arc has been completed

    (NOTE: The instrument should now be at line AD.)

3. Tighten horizontal-motion clamp screws

    (NOTE: Do not overtighten screws.)

4. Use tangent screw to make final 90-degree adjustments

5. Loosen vertical-motion clamp screws, and adjust tilt of instrument to sight at point D

6. Focus instrument on tack on stake at point D to determine whether line AD is straight

    (NOTE: If line AD is not straight, notify the instructor.)

7. Tighten vertical-motion clamp screws

D. Establish setup locations #1, #2, and #3 along line AB

1. Beginning at point A, use tape to measure along line AB to establish locations at distances of 8 feet, 36 feet, and 52 feet (See Figure 65)

    (NOTE: Do not disturb level-transit.)

2. Drive a stake at each location

3. Set a tack in top of each stake at exact measured distance from point A

E. Establish setup locations #4, #5, and #6 along line AD

1. Beginning at point A, use tape to measure along line AD to establish locations at distances of 30 feet, 52 feet, and 64 feet (See Figure 65)

    (NOTE: Do not disturb level-transit.)

2. Drive a stake at each location

3. Set a tack in top of each stake at exact measured distance from point A

F. Check tacks on setup stakes #4, #5, and #6 along line AD to make sure that they are in a straight line

1. With instrument still sighted on tack on stake at point D, focus instrument and take a reading to determine whether tacks on stakes #4, #5, and #6 along line AD are in a straight line

2. Have assistant adjust tacks on stakes as necessary

JOB SHEET #6

G. Check tacks on setup #1, #2, and #3 along line AB to make sure that they are in a straight line

   1. With instrument still focused on point D, set the 360-degree scale at zero

   2. Loosen horizontal-motion clamp screws, and turn instrument clockwise until the scale indicates that a 90-degree arc has been completed

      (NOTE: Level-transit should now be at line AB.)

   3. Tighten horizontal-motion clamp screws

      (NOTE: Do not overtighten screws.)

   4. Use tangent screw to make final 90-degree adjustments

   5. Loosen vertical-motion clamp screws, and adjust tilt of instrument to sight at point B

   6. Focus instrument and take a reading to determine whether tacks on setup stakes #1, #2, and #3 along line AB are straight

   7. Have assistant adjust tacks as necessary

   8. Tighten vertical-motion clamp screws

      (NOTE: Do not overtighten screws.)

H. Locate building-line points E and F on batter boards

   1. Set up and adjust level-transit over stake #1 at 8-foot location on line AB

      (NOTE: See Job Sheet #5.)

   2. Loosen vertical-motion clamp screws

   3. While assistant holds a nail on batter board, tilt instrument and sight through telescope to determine correct location for point E

   4. Have assistant adjust location of nail as necessary until correct location is established

   5. Have assistant drive nail into batter board at exact location established

   6. While assistant holds a nail on batter board, sight through telescope to determine correct location for point F

   7. Have assistant adjust location of nail as necessary until correct location is established

JOB SHEET #6

8. Have assistant drive nail into batter board at exact location established

9. Tighten vertical-motion clamp screws

   (NOTE: Do not overtighten screws.)

I. Locate building-line points G and H on batter boards

1. Set up and adjust level-transit over stake #2 at 36-foot location on line AB

   (NOTE: See Job Sheet #5.)

2. Loosen vertical-motion clamp screws

3. While assistant holds a nail on batter board, tilt instrument and sight through telescope to determine correct location for point G

4. Have assistant adjust location of nail as necessary until correct location is established

5. Have assistant drive nail into batter board at exact location established

6. While assistant holds a nail on batter board, sight through telescope to determine correct location for point H

7. Have assistant adjust location of nail as necessary until correct location is established

8. Have assistant drive nail into batter board at exact location established

9. Tighten vertical-motion clamp screws

   (NOTE: Do not overtighten screws.)

J. Locate building-line points I and J on batter boards

1. Set up and adjust level-transit over stake #3 at 52-foot location on line AB

   (NOTE: See Job Sheet #5.)

2. Loosen vertical-motion clamp screws

3. While assistant holds a nail on batter board, tilt instrument and sight through telescope to determine correct location for point I

4. Have assistant adjust location of nail as necessary until correct location is established

5. Have assistant drive nail into batter board at exact location established

JOB SHEET #6

6. While assistant holds a nail on batter board, sight through telescope to determine correct location for point J
7. Have assistant adjust location of nail as necessary until correct location is established
8. Have assistant drive nail into batter board at exact location established
9. Tighten vertical-motion clamp screws

(NOTE: Do not overtighten screws.)

K. Using procedure described above, set up level-transit over stake #4 at 30-foot location on line AD, and locate building-line points K and L on batter boards

L. Using procedure described above, set up level-transit over stake #5 at 52-foot location on line AD, and locate building-line points M and N on batter boards

M. Using procedure described above, set up level-transit over stake #6 at 64-foot location on line AD, and locate building-line points O and P on batter boards

N. Replace lens dust-cap, disassemble instrument from tripod, and store instrument in carrying case; store carrying case and tripod

O. Put away other tools and equipment

BUILDER'S LEVEL AND TRANSIT
UNIT I

TEST

NAME ____ SCORE ________________

1. Match to their correct definitions terms associated with leveling instruments. Write the correct numbers in the blanks. Terms and definitions continue on the next page.

_____a. Permanent point of known or assumed elevation

_____b. Proposed or future level of ground at construction line

_____c. Plot of ground on which a project is to be constructed

_____d. Given grade

_____e. Difference between elevations of two points on a slope

_____f. Rod with markings graduated upward from zero; used with leveling instruments to determine elevations

_____g. Vertical distance from bench mark to line of sight of leveling instrument

_____h. Automatic level that uses a laser beam to establish elevation readings

_____i. Elevation of finished floor in relation to bench mark

_____j. Leveling instrument consisting of a telescope and leveling bubble; used with a tripod and leveling rod primarily for establishing grade levels

_____k. Small book used to record instrument readings for layout and elevations of proposed structures

_____l. Tool or device attached to a string; used to set and check the vertical or perpendicular of a surface

_____m. Elevation reference point used when the permanent point is not in sight

1. Elevation
2. Grade line
3. Finish-floor height
4. Bench mark (BM)
5. Height of instrument (HI)
6. Field book
7. Fall
8. Site
9. Laser-beam instrument
10. Builder's level
11. Leveling rod
12. Temporary bench mark (TBM)
13. Plumb bob

TEST

______n. Stake driven into ground at proposed grade

______o. Leveling method by which the difference in elevation between two points is determined by plus and minus rod readings that are totaled and adjusted to bench mark

______p. Fine horizontal and vertical lines in telescope of leveling instrument; used as reference lines in the field or for marking instrumental axis

______q. Line from an observer's eye to a distant point toward which he or she is directing a leveling instrument

______r. System of lines or cross hairs in the focus of the eyepiece of an optical instrument

______s. Very precise leveling instrument used to establish straight lines and to measure horizontal and vertical angles

______t. Bearing relative to magnetic north

______u. Art or science of determining area and configuration of portions of the earth's surface with a maximum of accuracy

______v. Surveying method for determining distances and differences of elevation through means of a transit and rod

14. Differential leveling
15. Grade stake
16. Cross hairs
17. Line of sight
18. Transit
19. Magnetic bearing
20. Stadia
21. Reticle
22. Surveying

2. Discuss *stadia reticle.*

____

____

____

3. List uses of a level.

a. ____

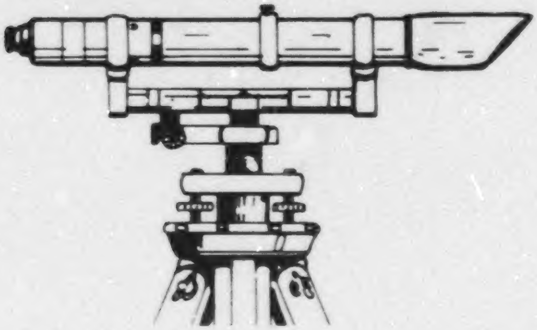
b. ____

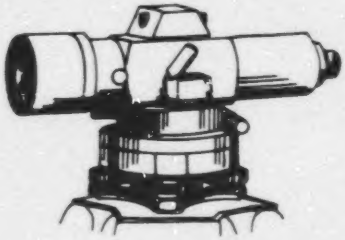
c. ____

TEST

4. Identify the following illustrations of types of levels. Write the correct names in the blanks. Illustrations continue on the next page.

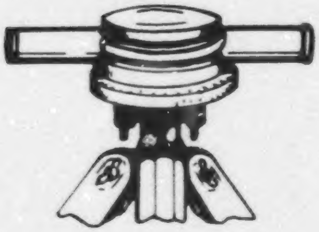
Builder's level
Turret level
Engineer's Zeiss level
Laser-beam instrument
Engineer's wild-tilting level
Automatic level
Engineer's dumpy level

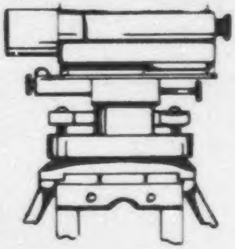




a. ______________________________

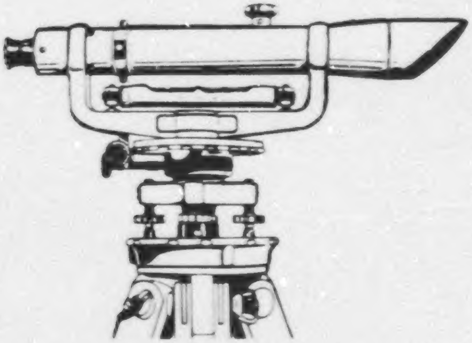
b. ______________________________

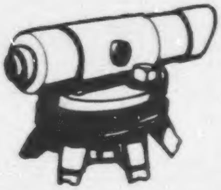




c. ______________________________

d. ______________________________

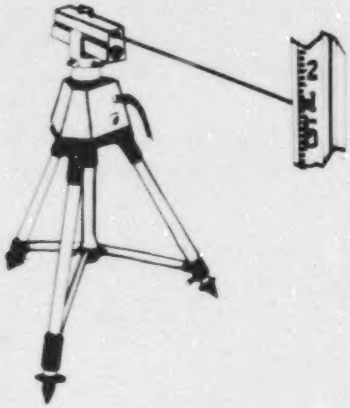




e. ______________________________

f. ______________________________

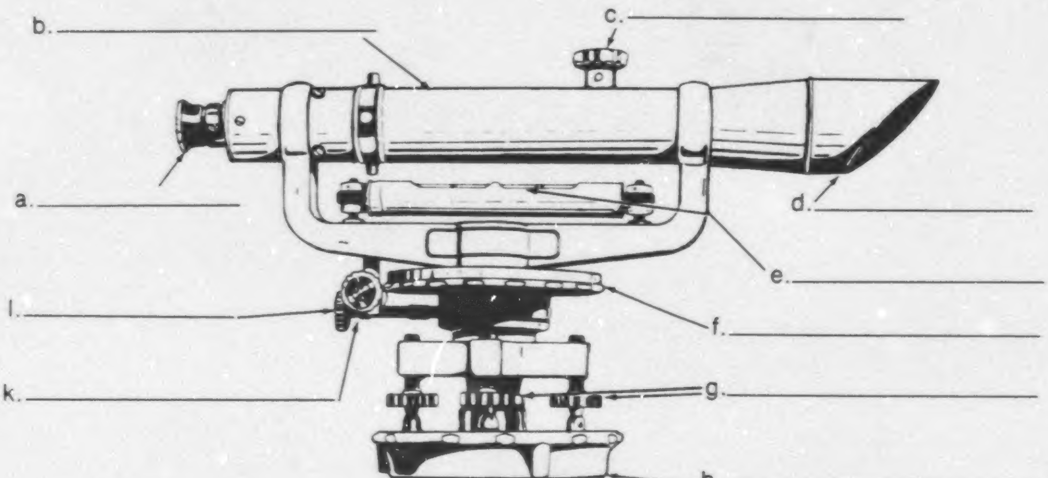
TEST



g. ______________________________

5. Identify the parts of the builder's level illustrated below. Write the correct names in the blanks.

Telescope
Slow-motion screw
Leveling screws
Leg thumb-nut
Leveling tube
Eyepiece
Sunshade
Degree scale
Focusing screw
Tripod
Clamp
Head plate


b. ______________________
c. ______________________
a. ______________________
d. ______________________
e. ______________________
l. ______________________
f. ______________________
k. ______________________
g. ______________________
h. ______________________
j. ______________________
i. ______________________

TEST

6. List four uses of a transit.

a. ____

b. ____

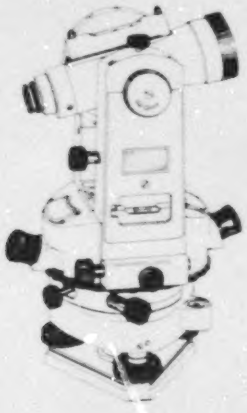
c. ____

d. ____

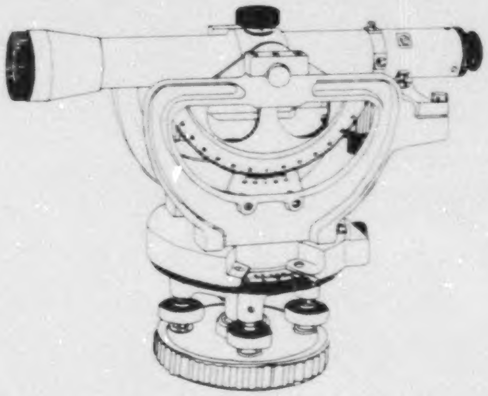
7. Identify the types of transits illustrated below. Write the correct names in the blanks.

Optical transit
Engineer's transit

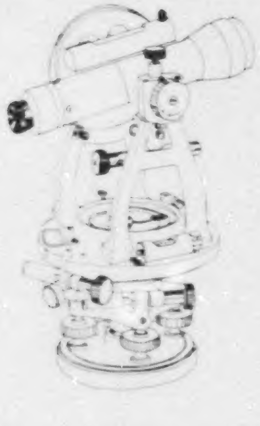
Optical plummet transit
Combination level-transit



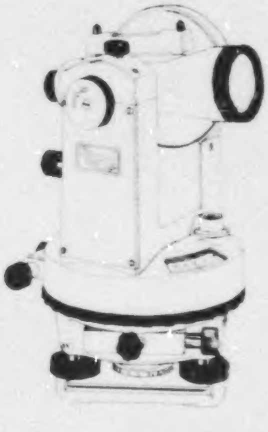
a. ______________________________



b. ______________________________



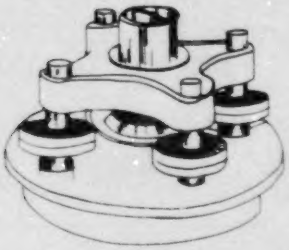
c. ______________________________

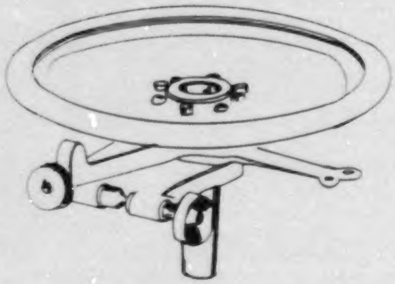


d. ______________________________

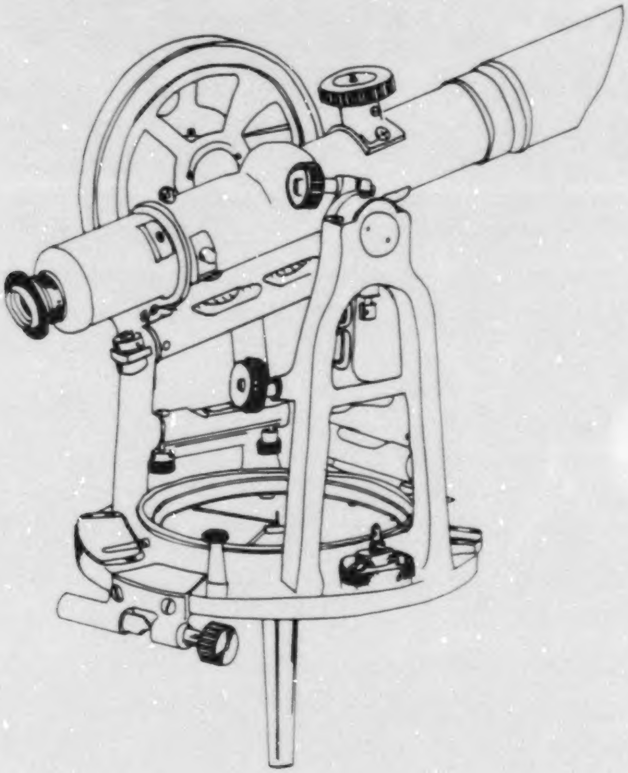
TEST

8. Label the major components of an engineer's transit.





a. ______________________ b. ______________________



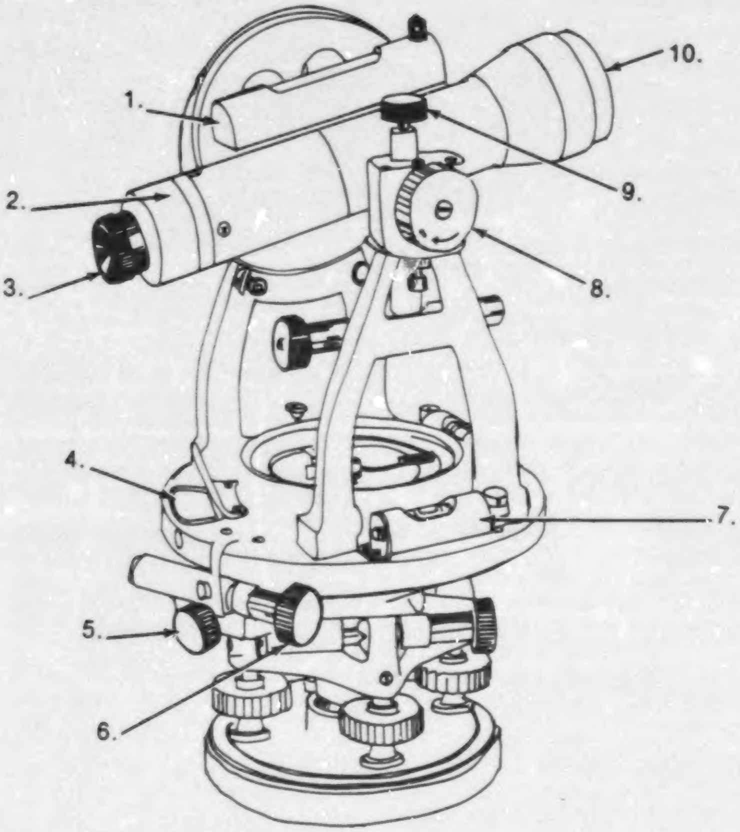
c. ______________________

TEST

9. Identify the parts of the engineer's transit illustrated in the following views. Write the correct names in the blanks. View b is on the next page.

Upper-motion tangent screw
Telescope level vial
Eyepiece
Telescope clamp screw
Telescope focusing pinion
Telescope
Objective lens
Upper-motion clamp screw
Plate level vial
Horizontal circle and vernier

View a

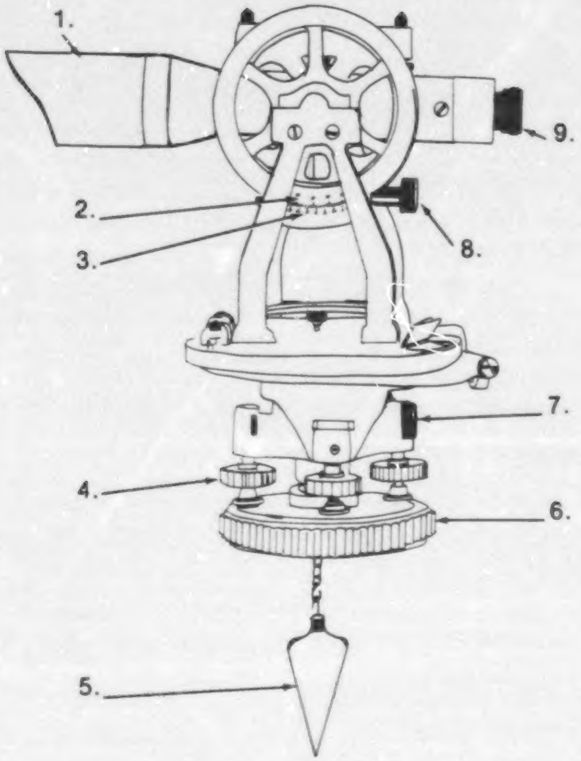


1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________
9. ______________________________
10. ______________________________

TEST

Vertical vernier
Sunshade
Baseplate
Lower-motion tangent screw
Vertical circle
Leveling screw
Plumb bob
Focusing ring
Telescope tangent screw

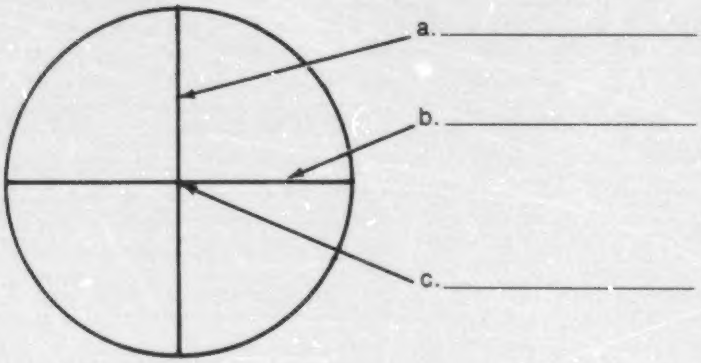
View b



1. ______________________
2. ______________________
3. ______________________
4. ______________________
5. ______________________
6. ______________________
7. ______________________
8. ______________________
9. ______________________

TEST

10. Label vertical and horizontal cross hairs and line of sight on the leveling instrument illustrated below.



11. State five rules for proper care of leveling instruments.

a. ____

b. ____

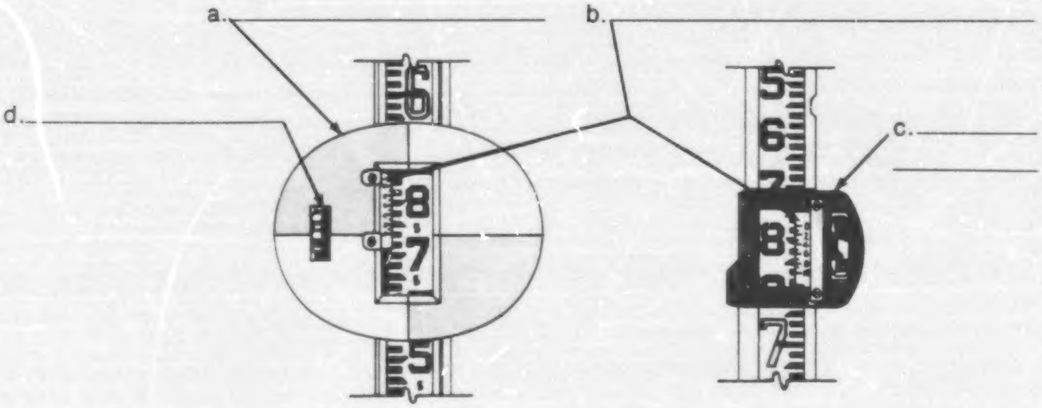
c. ____

d. ____

e. ____

12. Identify the parts of the leveling rod illustrated below. Write the correct names in the blanks.

Rod clamp **Target clamp** **Vernier scale** **Target**



TEST

13. Match parts of a leveling rod to their correct uses. Write the correct numbers in the blanks.

______a. Holds target in place	1. Target
______b. Holds rod open when extended	2. Target clamp
______c. Helps make measurements within a certain range on leveling rod; holds vernier scale	3. Vernier scale
______d. Enables reading to the nearest thousandth of a foot or nearest sixty-fourth of a foot	4. Rod clamp

14. Describe commonly used direct-reading rods.

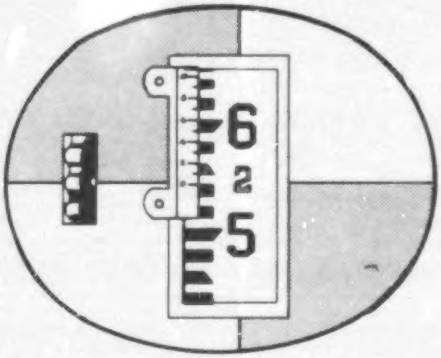
a. Rod graduated in eighths of an inch — ______________________________

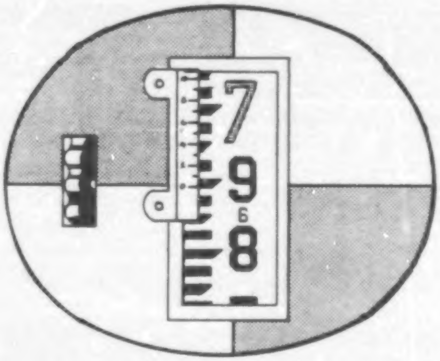
____

b. Rod graduated in hundredths of a foot — ______________________________

____

15. Read each of the following illustrations of direct-reading rods to the nearest hundredth or eighth. Write the correct answers in the blanks. Illustrations continue on the next page.

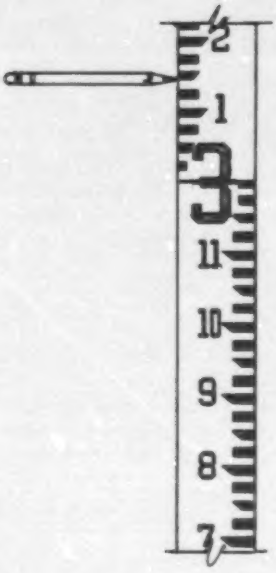


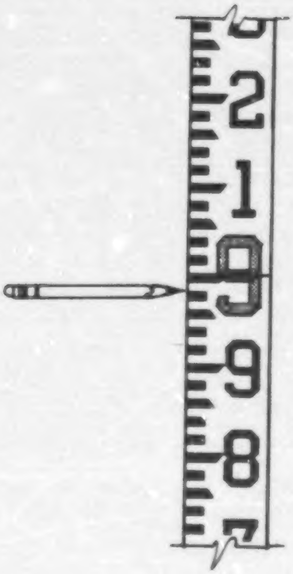


a. ______________________________

b. ______________________________

TEST

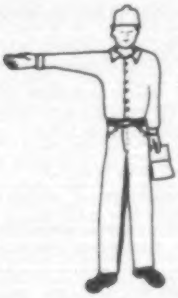


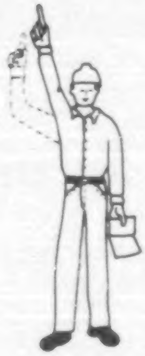


c. ______________________________ d. ______________________________

16. Identify hand signals used by the instrument person to guide the rod person. Write the correct names in the blanks. Some blanks may contain more than one answer. Some answers may be used more than once. Illustrations continue on the next two pages.

Observation completed
Turning point
Move down
Check clamp
Rod upside down
Move in this direction
Wave rod from side to side
Move on
Understand
Move up
Wrong face
Use long rod
Come in

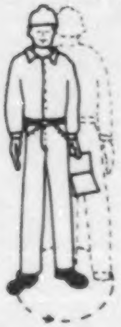


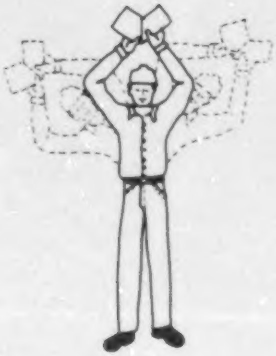


a. ______________________________ b. ______________________________

______________________________ ______________________________

TEST



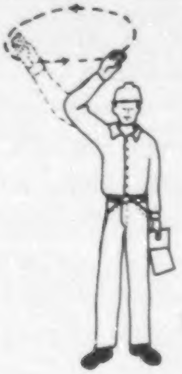


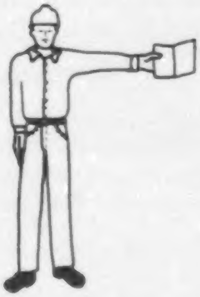
c. ______________________________

____

d. ______________________________

____



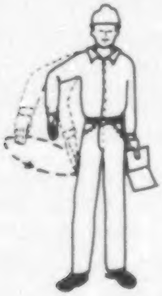


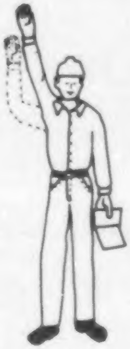
e. ______________________________

____

f. ______________________________

____





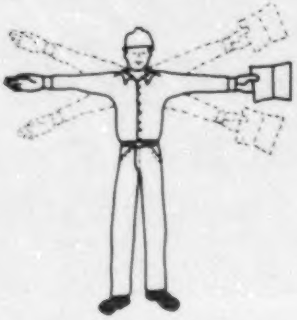
g. ______________________________

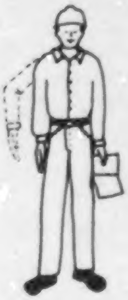
____

h. ______________________________

____

TEST





i. ______________________________

____

j. ______________________________

____

(NOTE: Test question 17 lists the job sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

17. Demonstrate the ability to

    a. Set up and adjust a builder's level.

    b. Use a builder's level to check footing elevations.

    c. Use a builder's level to perform differential leveling.

    d. Connect plumb bob to transit.

    e. Set up and adjust a combination level-transit.

    f. Use a combination level-transit to locate building-line points on batter boards.

BUILDER'S LEVEL AND TRANSIT
UNIT I

ANSWERS TO TEST

1. a. 4
   b. 2
   c. 8
   d. 1
   e. 7
   f. 11
   g. 5
   h. 9
   i. 3
   j. 10
   k. 6
   l. 13
   m. 12
   n. 15
   o. 14
   p. 16
   q. 17
   r. 21
   s. 18
   t. 19
   u. 22
   v. 20

2. Discussion should include the following

   Additional horizontal lines in the telescope eyepiece; used to determine distance between leveling rod and plumb bob

3. a. Establishing elevations and grades
   b. Establishing differential elevations
   c. Transferring elevations from one point to another

4. a. Engineer's dumpy level
   b. Automatic level
   c. Turret level
   d. Engineer's wild-tilting level
   e. Builder's level
   f. Engineer's Zeiss level
   g. Laser-beam instrument

5. a. Eyepiece
   b. Telescope
   c. Focusing screw
   d. Sunshade
   e. Leveling tube
   f. Degree scale
   g. Leveling screws
   h. Head plate
   i. Tripod
   j. Leg thumb-nut
   k. Slow-motion screw
   l. Clamp

6. Answer should include any four of the following

   a. Measuring horizontal angles
   b. Measuring vertical angles
   c. Measuring elevations
   d. Measuring horizontal and vertical distances
   e. Determining magnetic bearings
   f. Laying out boundaries and building lines
   g. Establishing elevations and grades

7. a. Optical transit
   b. Combination level-transit
   c. Engineer's transit
   d. Optical plummet transit

ANSWERS TO TEST

8. a. Leveling head
   b. Horizontal circle
   c. Alidade

9. **View a**
   1. Telescope level vial
   2. Telescope
   3. Eyepiece
   4. Horizontal circle and vernier
   5. Upper-motion clamp screw
   6. Upper-motion tangent screw
   7. Plate level vial
   8. Telescope focusing pinion
   9. Telescope clamp screw
   10. Objective lens

   View b
   1. Sunshade
   2. Vertical circle
   3. Vertical vernier
   4. Leveling screw
   5. Plumb bob
   6. Baseplate
   7. Lower-motion tangent screw
   8. Telescope tangent screw
   9. Focusing ring

10. a. Vertical cross hair
    b. Horizontal cross hair
    c. Line of sight

11. Answer should include any five of the following

    a. Keep instrument in carrying case when not in use
    b. Protect instrument from shock and vibration when transporting
    c. Remove instrument from carrying case by lifting the level bar
    d. Never force screws or other moving parts of the instrument
    e. Place lens and tripod caps in carrying case after removing them from instrument
    f. Do not remove lenses
    g. Clean lenses with soft tissue only
    h. Always use sunshade regardless of weather
    i. Loosen leveling screws before returning instrument to carrying case
    j. Carry tripod under your arm with the instrument in front of you

12. a. Target
    b. Vernier scale
    c. Rod clamp
    d. Target clamp

ANSWERS TO TEST

13. a. 2 c. 1
    b. 4 d. 3

14. Description should include the following

    a. Rod graduated in eighths of an inch—Marks indicate feet, inches, and eighths of an inch; each line and space is one-eighth of an inch thick
    b. Rod graduated in hundredths of a foot—Marks indicate feet, tenths of a foot, and hundredths of a foot; each line and space is one hundredth of a foot thick

15. a. 2.54′
    b. 6.89′
    c. 3′ – 1$\frac{3}{8}$″
    d. 8.98′

16. a. Move in this direction
    b. Move up
    c. Wrong face; check clamp; rod upside down
    d. Wave rod from side to side
    e. Turning point
    f. Move in this direction
    g. Come in
    h. Use long rod
    i. Observation completed; move on; understand
    j. Move down

17. Performance skills evaluated to the satisfaction of the instructor

SITE LAYOUT
UNIT II

UNIT OBJECTIVE

After completing this unit, the student should be able to erect batter boards, locate building lines, lay out footings, square building lines, and set grade stakes. The student will show this knowledge by completing the assignment sheet, job sheets, and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match to their correct definitions terms associated with site layout.
2. Match to their correct definitions terms pertaining to grades and leveling instruments.
3. Name factors pertinent to site layout.
4. Select from a list information used to lay out building lines.
5. State the purpose of batter boards.
6. Describe common methods used to square building lines.
7. Demonstrate the ability to
   a. Erect batter boards and locate building lines for a structure.
   b. Lay out footings for a structure.
   c. Set grade stakes for footings without forms.

SITE LAYOUT
UNIT II

SUGGESTED ACTIVITIES

I. Unit contents

A. Objective sheet

B. Suggested activities

C. Transparency master: TM #1 — Plot Plan

D. Information sheet

E. Assignment Sheet #1 — Write Layout Dimensions on a Plot Plan

F. Answers to assignment sheet

G. Job sheet supplements

1. Job Sheet Supplement #1 — Plot Plan

2. Job Sheet Supplement #2 — Foundation Plan

3. Job Sheet Supplement #3 — Floor Plan

H. Job sheets

1. Job Sheet #1 — Erect Batter Boards and Locate Building Lines for a Structure

2. Job Sheet #2 — Lay Out Footings for a Structure

3. Job Sheet #3 — Set Grade Stakes for Footings Without Forms

I. Test

J. Answers to test

II. Instructor's guide

A. Obtain materials to supplement unit.

1. Set of local regulations, covenants, and zoning laws

2. Appropriate site-layout instrument or combination transit and rod

3. Equipment and materials necessary for students to complete job sheets

SUGGESTED ACTIVITIES

4. Copies of various plot plans

5. Transparency and competency profiles

(NOTE: Transparency and competency profiles are available from The Associated General Contractors of America, 1957 E Street N.W., Washington, D. C. 20006, or from the Oklahoma State Department of Vocational and Technical Education, Curriculum and Instructional Materials Center, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074.)

B. Introduce unit to students.

SUGGESTIONS:

- Review "Measuring" and "Plan Reading," Units II and III, Section B.
- Review "Builder's Level and Transit," Unit I, Section D.
- Emphasize to students the importance of knowing local regulations, covenants, restrictions, and zoning laws. Explain how knowing the laws and regulations could save them time, money, and possible lawsuits.
- Point out that accuracy is essential in site layout: The cost of redoing or making architectural changes may be prohibitive or unacceptable.
- Liken site layout to a journey. The first step may mean the difference between a successful journey and being lost.

C. Provide students with objective sheet.

D. Discuss unit and specific objectives.

E. Provide students with information, assignment, and job sheets.

F. Discuss information, assignment, and job sheets.

1. Use Information Sheet, Section I to discuss terms and definitions associated with site layout.

SUGGESTIONS:

- Explain that an understanding of terms related to site layout is essential for reading and understanding plans and covenants.
- Explain that commonality of term meanings is required for communication with workers within the trade and with workers from related trades employed on the job site.

SUGGESTED ACTIVITIES

2. Use Information Sheet, Section II to discuss terms and definitions pertaining to grades and leveling instruments.

   SUGGESTIONS:

   - Take students on a field trip to a construction site on which workers are laying out a building.
   - Have an open quiz by asking for the definition of each term or by giving the definition and asking for the appropriate term.
   - Show students examples of appropriate terms.

3. Use Information Sheet, Section III to discuss factors pertinent to site layout.

   SUGGESTIONS:

   - Hand out copies of local regulations and covenants for a construction project. Have students read covenants and locate particulars. Discuss in class and answer questions as they arise.
   - Invite a utility company representative to discuss locating utilities and to relate case studies of problems that have been encountered.

4. Use Information Sheet, Section IV to discuss information used to lay out building lines.

   SUGGESTIONS:

   - Provide students with various plot plans and use Transparency #1 to illustrate information related to laying out building lines.
   - Have students practice recognizing layout dimensions on a plot plan by having them complete Assignment Sheet #1.

5. Use Information Sheet, Section V to discuss the purpose of batter boards.

   SUGGESTION:

   - Demonstrate procedures and have students erect batter boards as outlined in part II C of Job Sheet #1.

6. Use Information Sheet, Section VI to discuss methods used to square building lines.

   SUGGESTIONS:

   - Have students use stakes and strings to practice squaring corners. Practice could be done inside using chalk and string if the weather is inclement.
   - Demonstrate procedures and have students complete part II D of Job Sheet #1.

SUGGESTED ACTIVITIES

- Set up a contest to see who can correctly lay out building lines, maintain square, and shoot correct grades most quickly or efficiently.
- Demonstrate procedures and have students complete Job Sheets #2 and #3.

G. Review information.

H. Give test.

I. Critique test and discuss in class.

J. Complete appropriate section of competency profiles.

III. Unit references

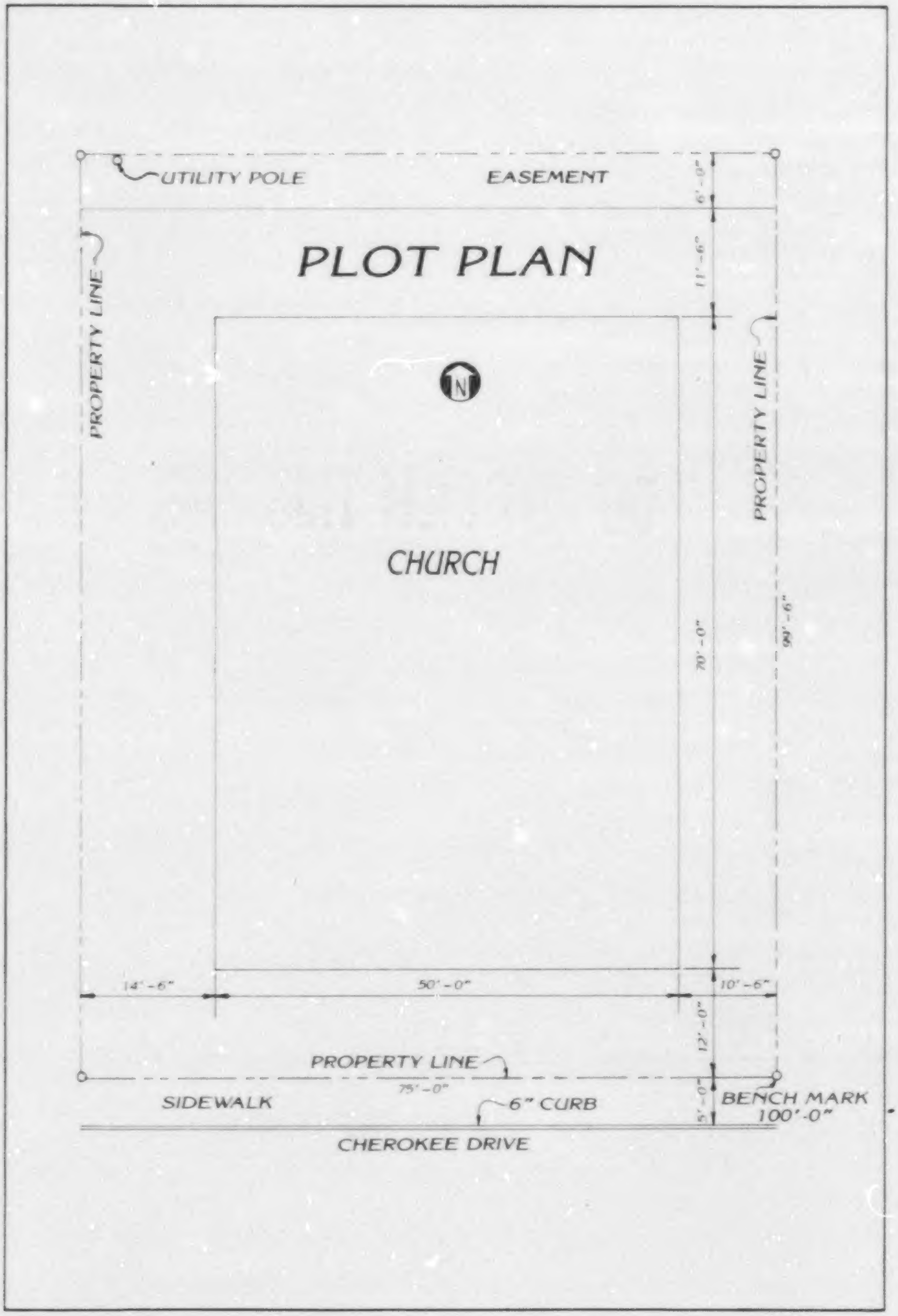
A. Burke, Arthur E., Ralph J. Dalzelle, and Gilbert Townsend. *Architectural and Building Trades Dictionary.* Chicago, Illinois: American Technical Society, 1955.

B. Durbahn, Walter E., and Elmer W. Sundberg. *Fundamentals of Carpentry,* 3rd ed. Chicago, Illinois: American Technical Society, 1963.

C. Hendrix, Laborn J. "Bud". *Commercial Carpentry Curriculum Material.* Stillwater, Oklahoma: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, and The Associated General Contractors of America, 1979.

D. Lair, E. A. *Carpentry for the Building Trades.* St. Louis, Missouri: McGraw-Hill, 1953.

E. Smith, Ronald C. *Principles and Practices of Heavy Construction.* Englewood Cliffs, New Jersey: Prentice-Hall, 1970.


UTILITY POLE
EASEMENT
6'-0"
PLOT PLAN
11'-6"
PROPERTY LINE
N
PROPERTY LINE
CHURCH
70'-0"
99'-6"
14'-6"
50'-0"
10'-6"
12'-0"
PROPERTY LINE
75'-0"
SIDEWALK
6" CURB
5'-0"
BENCH MARK
100'-0"
CHEROKEE DRIVE

SITE LAYOUT
UNIT II

INFORMATION SHEET

I. Terms and definitions associated with site layout

A. Batter board — Temporary framework on which to stretch a line to assist in locating corners and building lines when laying out a building (Figures 1 and 2)

EXAMPLES:

FIGURE 1: Straight batter board

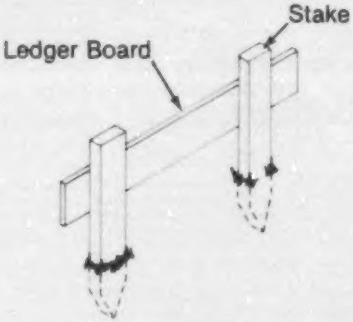
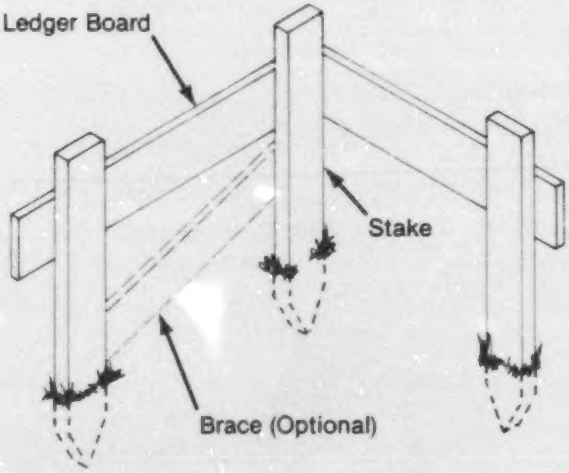

Stake
Ledger Board

FIGURE 2: Right-angle batter board


Ledger Board
Stake
Brace (Optional)

INFORMATION SHEET

B. Building permit — Agreement between builder and city that specifies the type, quality, and extent of construction on structure to be erected

C. Easement — A vested or acquired right to use land, other than as a tenant, for a specific purpose; such right being held by someone other than the owner who holds the title to the land

D. Excavating — Removing soil for footing or for establishing a uniform grade

E. Ledger board — Top horizontal board on batter-board framework

F. Plot plan — Drawing used to show location and size of structure(s), driveways, sidewalks, patios, property lines, utilities, and existing conditions

G. Plumb bob — Tool or device attached to a string; used to set or check plumb or perpendicular of a surface

H. Plumb down — To plumb from a given point down to a point below

I. Property lines — Boundaries of a lot or plot of ground

J. Kerf — Slight indentation made with a saw; used to hold line in place

K. Surveying — Art or science of determining the area and configuration of portions of the earth's surface

L. Setback line — Line established by law, fixing exterior face of structure a minimum distance from right-of-way or property line

II. Terms and definitions pertaining to grades and leveling instruments

A. Bench mark (BM) — Permanent point of known or assumed elevation

(NOTE: A specific point on a curb, culvert, or other permanent object is sometimes used.)

B. Builder's level — Instrument consisting of a telescope, leveling bubble, and tripod; used primarily for establishing grade levels

C. Elevation — Given grade

D. Fall — The slope of a line, such as inches of fall per foot of run

EXAMPLE: 1 inch fall per 1 foot of run

E. Fill — Soil or other substance used to raise grade level

F. Finish-floor grade — Elevation of finished floor in relation to bench mark

INFORMATION SHEET

G. Grade line — Proposed or future level of ground around structure

H. Grade stake — Stake driven into ground, usually with top establishing finished level of ground or concrete at that point

(NOTE: Grade for the stake is read from the bench mark.)

I. Height of instrument (HI) — Vertical distance from bench mark to line of sight of instrument

J. Leveling rod — Rod used with builder's level; graduated in tenths and hundredths of a foot or in inches and feet

K. Transit — Instrument consisting of a telescope, leveling bubble, leveling head, and tripod; used primarily to establish angles and straight lines

III. Factors pertinent to site layout

A. Local regulations and covenants (zoning and restrictions)

EXAMPLES: Setback line; proximity to side property lines; elevation, size, shape, and proximity to surrounding buildings and areas

B. Location of utilities

EXAMPLES: Electricity, sewers, gas, phone

C. Presence of existing trees and shrubs

D. Contour or shape of site

EXAMPLES: Flat, rolling, sloping

E. Characteristics of soil

F. Orientation of site

EXAMPLES: Relationship to other sites; north, east, south, and west boundaries; wind direction; solar-utilization possibilities

IV. Information used to lay out building lines

A. Dimensions of property

B. Setback from curb

C. Setback from sidewalk

D. Setback from property lines

INFORMATION SHEET

E. Distance from side boundaries

F. Distance from rear property line

G. Location and dimensions of easement(s)

H. Dimensions (length and width) of building

I. Orientation of building on lot (square or diagonal)

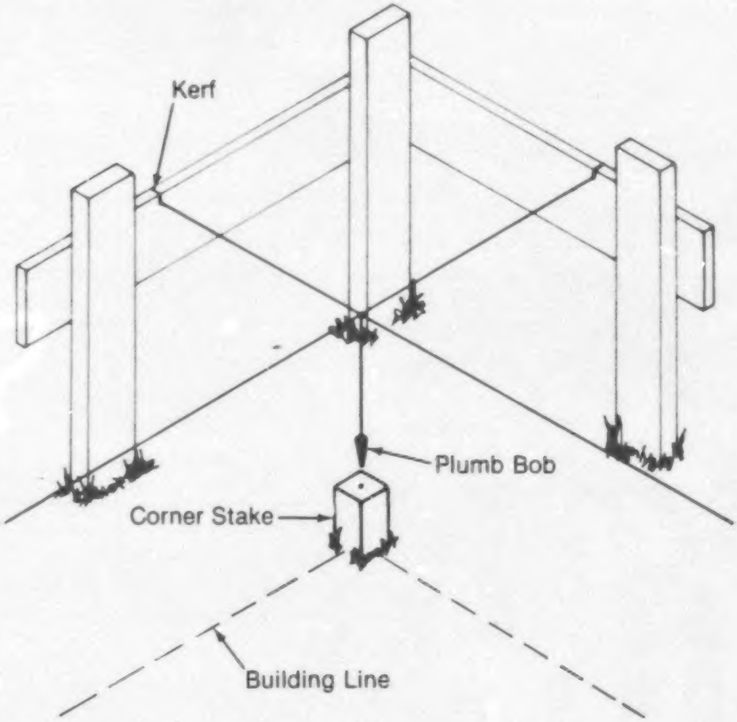
J. Location of bench mark and grade

V. Purpose of batter boards — To provide a place for stretching a line used to establish building lines for excavation and construction (Figure 3)

(NOTE: Steel stakes are sometimes used in place of batter boards.)

EXAMPLE: Using batter boards to set up building lines

FIGURE 3



INFORMATION SHEET

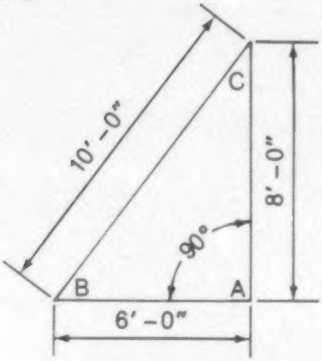
VI. Common methods used to square building lines

A. 3-4-5 rule — Forming a right triangle using largest multiple of 3-4-5 possible for length of lines being squared, and ensuring that longest side of triangle is exact appropriate multiple of 5

(NOTE: Any multiple of 3-4-5 may be used [i.e., 6-8-10, 12-16-20, 24-32-40] depending on the size being checked.)

EXAMPLE: Using 3-4-5 rule to square building lines 6′ –0″ × 8′ –0″, line BC will measure exactly 10 feet if lines AB and AC are square (Figure 4).

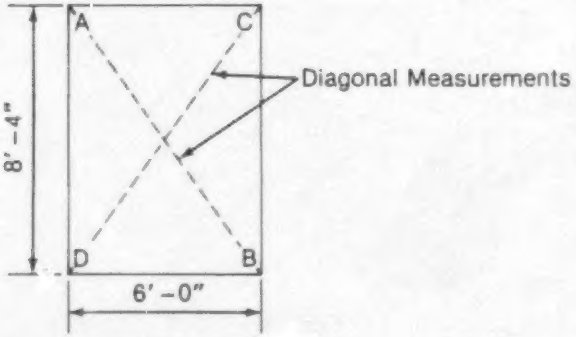
FIGURE 4



B. Diagonal method — Measuring diagonally from inside corners of layout and ensuring that diagonal lines are equal in length

EXAMPLE: Using the diagonal method to square building lines 6′ –0″ × 8′ – 4″, lines AB and CD will be exactly the same measurement if building lines are square (Figure 5).

FIGURE 5

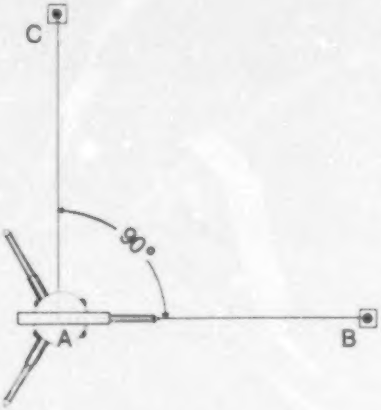


INFORMATION SHEET

C. Transit method — Setting instrument exactly at point where right angle is to be, sighting a reference point on one line of angle, setting 360-degree scale at zero, and establishing second line of angle where scale indicates a 90-degree arc has been completed

EXAMPLE: Using instrument to square corners of building lines, when instrument is at point A and sighted on a point on line AB, 360-degree scale will indicate that an arc of 90 degrees has been completed at line AC (Figure 6).

FIGURE 6



INFORMATION SHEET

G. Grade line — Proposed or future level of ground around structure

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(NOTE: Grade for the stake is read from the bench mark.)

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K. Transit — Instrument consisting of a telescope, leveling bubble, leveling head, and tripod; used primarily to establish angles and straight lines

III. Factors pertinent to site layout

A. Local regulations and covenants (zoning and restrictions)

EXAMPLES: Setback line; proximity to side property lines; elevation, size, shape, and proximity to surrounding buildings and areas

B. Location of utilities

EXAMPLES: Electricity, sewers, gas, phone

C. Presence of existing trees and shrubs

D. Contour or shape of site

EXAMPLES: Flat, rolling, sloping

E. Characteristics of soil

F. Orientation of site

EXAMPLES: Relationship to other sites; north, east, south, and west boundaries; wind direction; solar-utilization possibilities

IV. Information used to lay out building lines

A. Dimensions of property

B. Setback from curb

C. Setback from sidewalk

D. Setback from property lines

INFORMATION SHEET

E. Distance from side boundaries

F. Distance from rear property line

G. Location and dimensions of easement(s)

H. Dimensions (length and width) of building

I. Orientation of building on lot (square or diagonal)

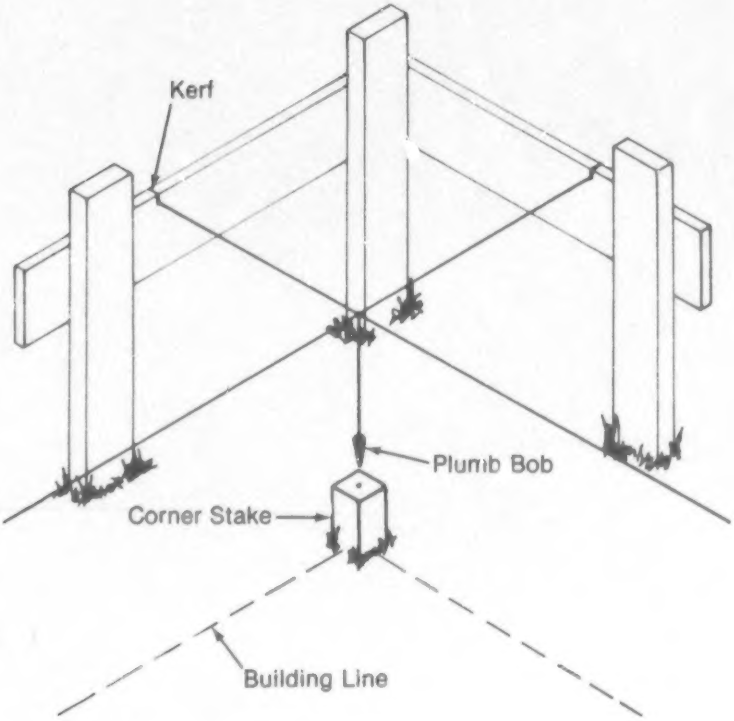
J. Location of bench mark and grade

V. Purpose of batter boards — To provide a place for stretching a line used to establish building lines for excavation and construction (Figure 3)

(NOTE: Steel stakes are sometimes used in place of batter boards.)

EXAMPLE: Using batter boards to set up building lines

FIGURE 3



INFORMATION SHEET

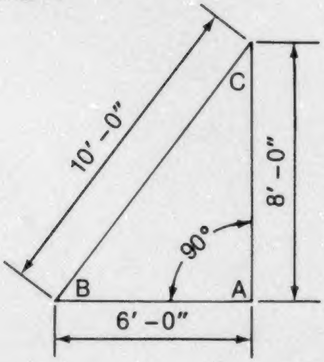
VI. Common methods used to square building lines

A. 3-4-5 rule — Forming a right triangle using largest multiple of 3-4-5 possible for length of lines being squared, and ensuring that longest side of triangle is exact appropriate multiple of 5

(NOTE: Any multiple of 3-4-5 may be used [i.e., 6-8-10, 12-16-20, 24-32-40] depending on the size being checked.)

EXAMPLE: Using 3-4-5 rule to square building lines 6′ –0″ x 8′ –0″, line BC will measure exactly 10 feet if lines AB and AC are square (Figure 4).

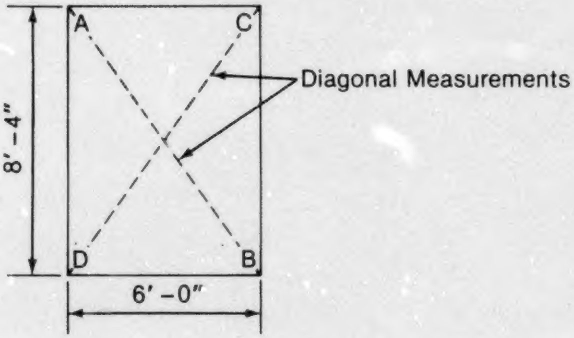
FIGURE 4



B. Diagonal method — Measuring diagonally from inside corners of layout and ensuring that diagonal lines are equal in length

EXAMPLE: Using the diagonal method to square building lines 6′ –0″ x 8′ – 4″, lines AB and CD will be exactly the same measurement if building lines are square (Figure 5).

FIGURE 5

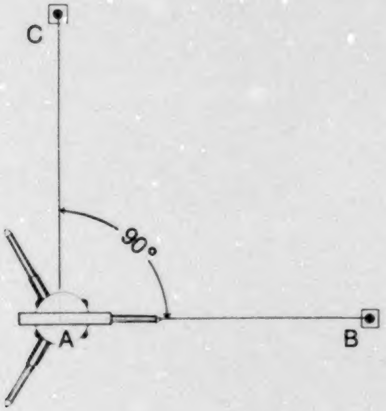


INFORMATION SHEET

C. Transit method — Setting instrument exactly at point where right angle is to be, sighting a reference point on one line of angle, setting 360-degree scale at zero, and establishing second line of angle where scale indicates a 90-degree arc has been completed

EXAMPLE: Using instrument to square corners of building lines, when instrument is at point A and sighted on a point on line AB, 360-degree scale will indicate that an arc of 90 degrees has been completed at line AC (Figure 6).

FIGURE 6



SITE LAYOUT
UNIT II

ASSIGNMENT SHEET #1 — WRITE LAYOUT DIMENSIONS ON A PLOT PLAN

NAME ____ SCORE ________________

In order to be able to lay out a building site correctly, the carpenter must be able to read dimensions on a plot plan.

Review Information Sheet, Sections III and IV, and then write the dimensions below in the correct places on the plot plan on the following page.

Property dimensions

- Front—75′ -0″
- Rear—75′ -0″
- East side—99′ -6″
- West side—99′ -6″

Building size—65′ -0″ × 54′ -0″

(NOTE: Building should be parallel with boundary lines.)

Bench mark—100′ -0″

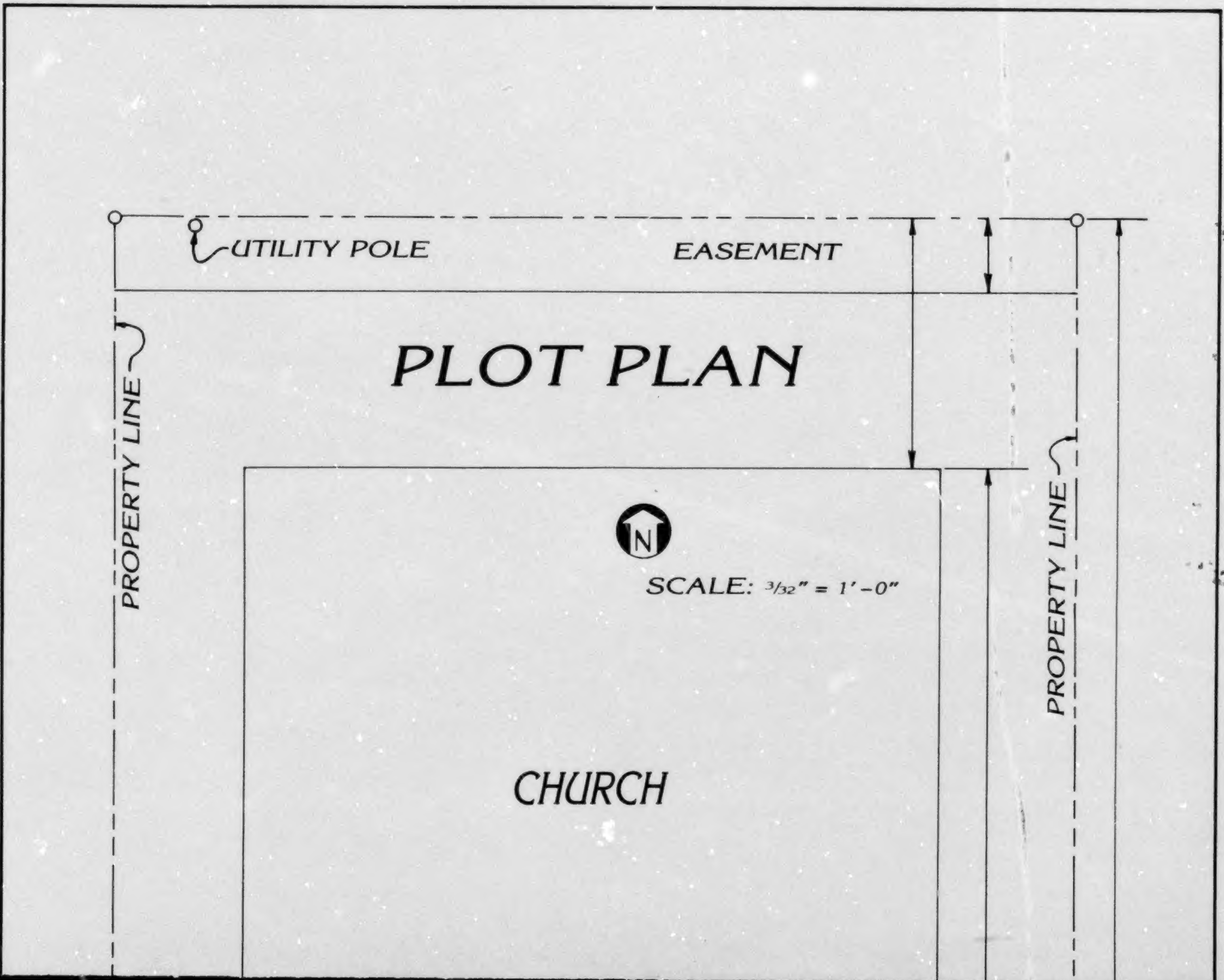
Easement—5′ - 11″ at rear of property

Sidewalk

- 4′ -0″ wide
- 6′ - 10″ from building

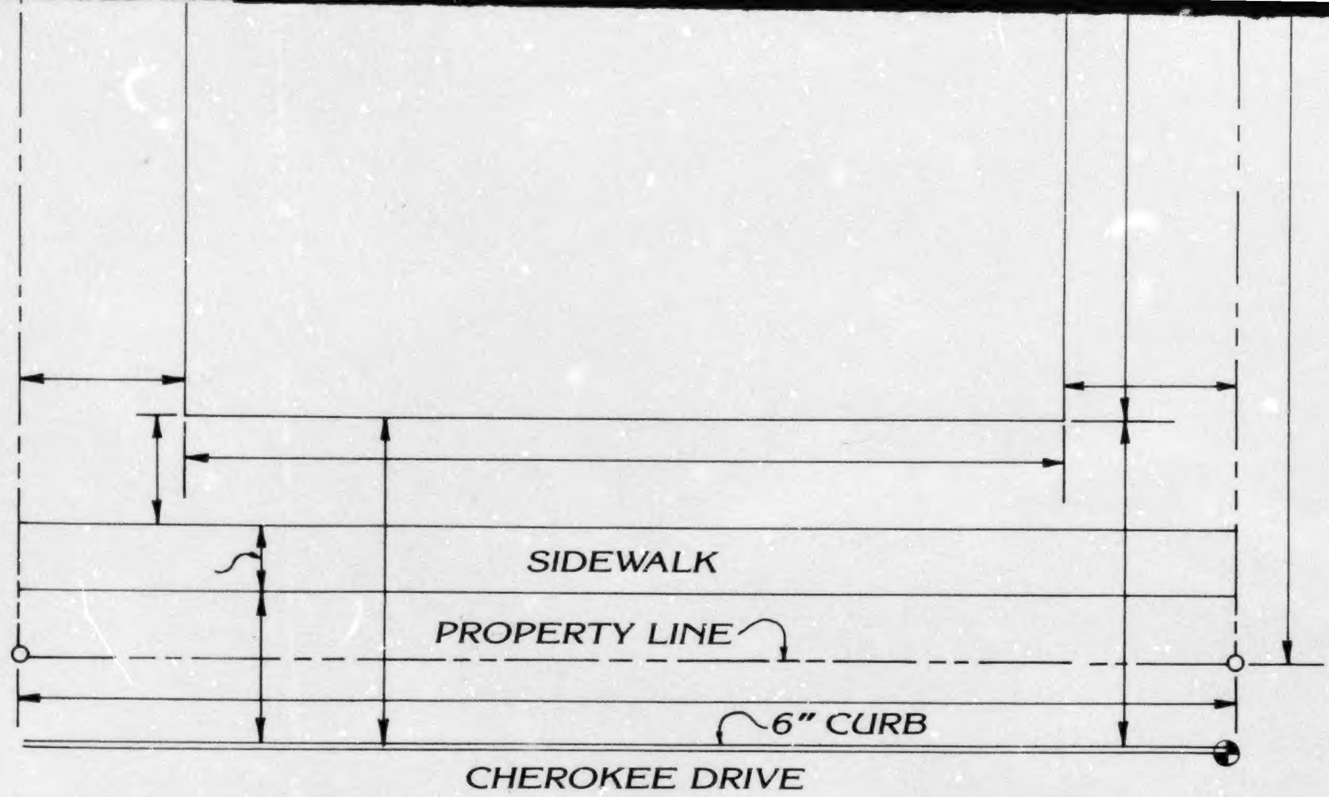
Setbacks

- 20′ -5″ from center of curb
- 15′ -0″ from south property line
- 10′ -2″ from west property line
- 10′ - 10″ from east property line
- 19′ -6″ from north property line


UTILITY POLE
EASEMENT
PLOT PLAN
PROPERTY LINE
PROPERTY LINE
N
SCALE: 3/32" = 1'-0"
CHURCH

ASSIGNMENT SHEET #1

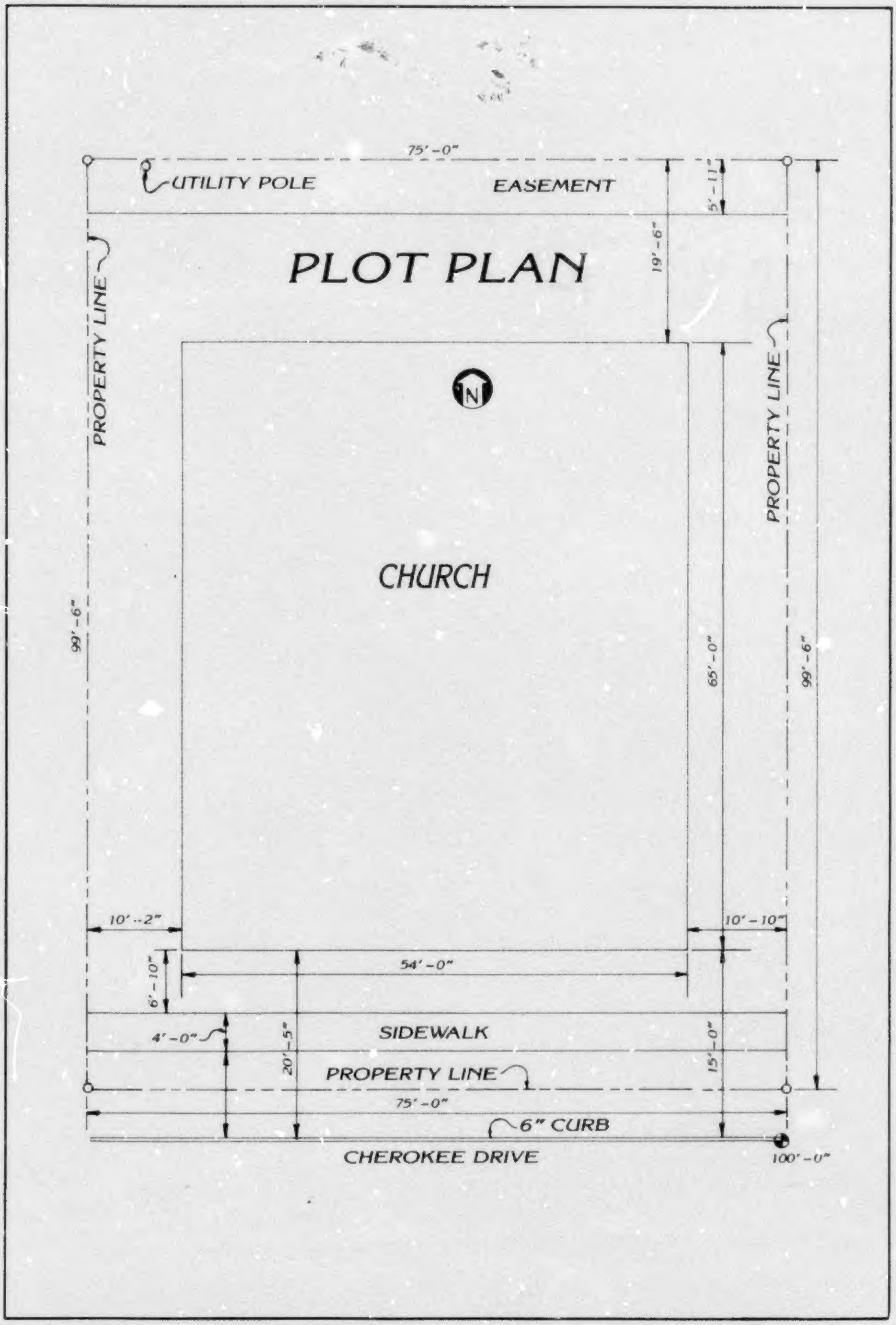
FC-101-D

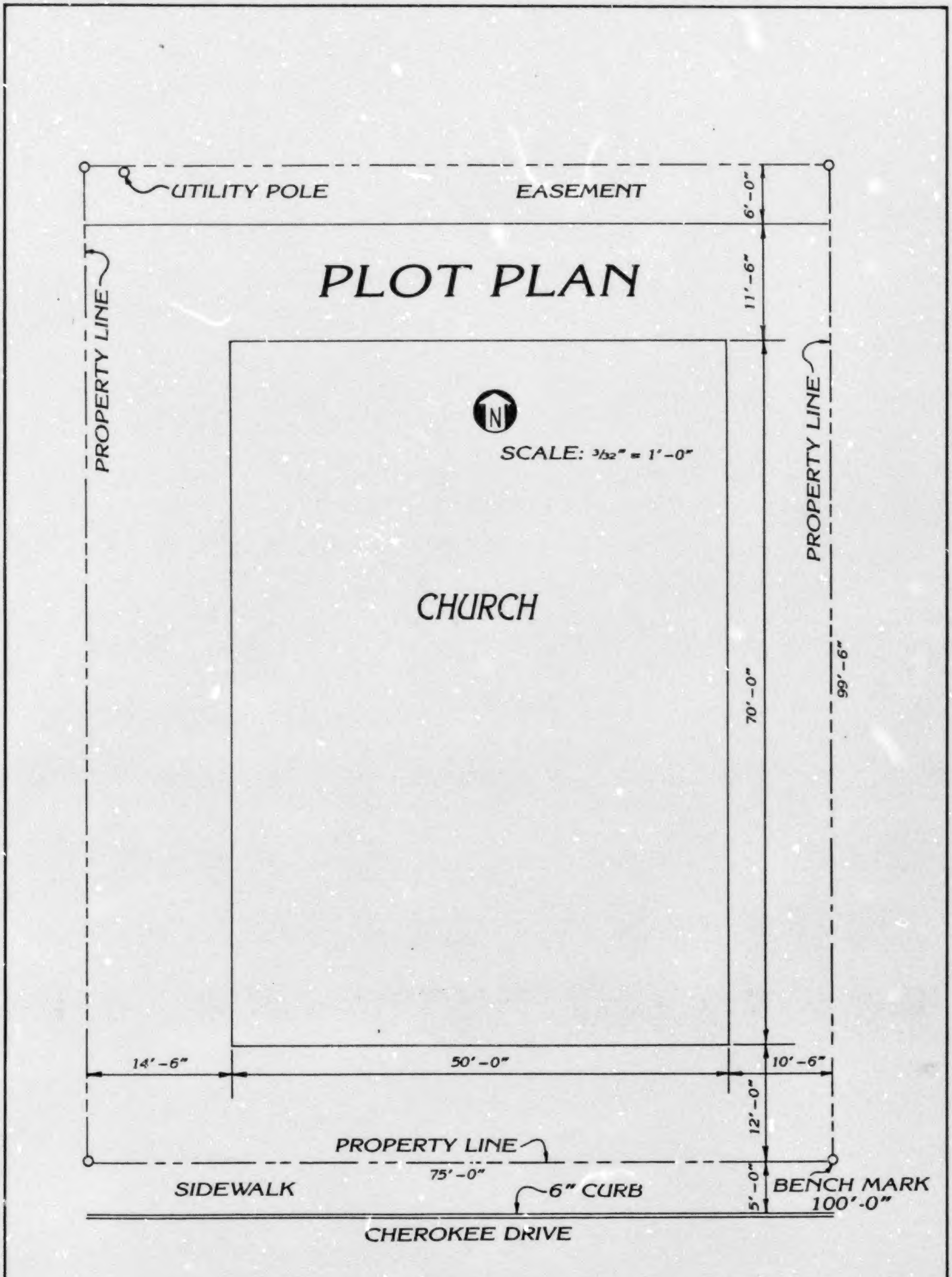

SIDEWALK
PROPERTY LINE
6" CURB
CHEROKEE DRIVE

963 B

SITE LAYOUT
UNIT II

ANSWERS TO ASSIGNMENT SHEET

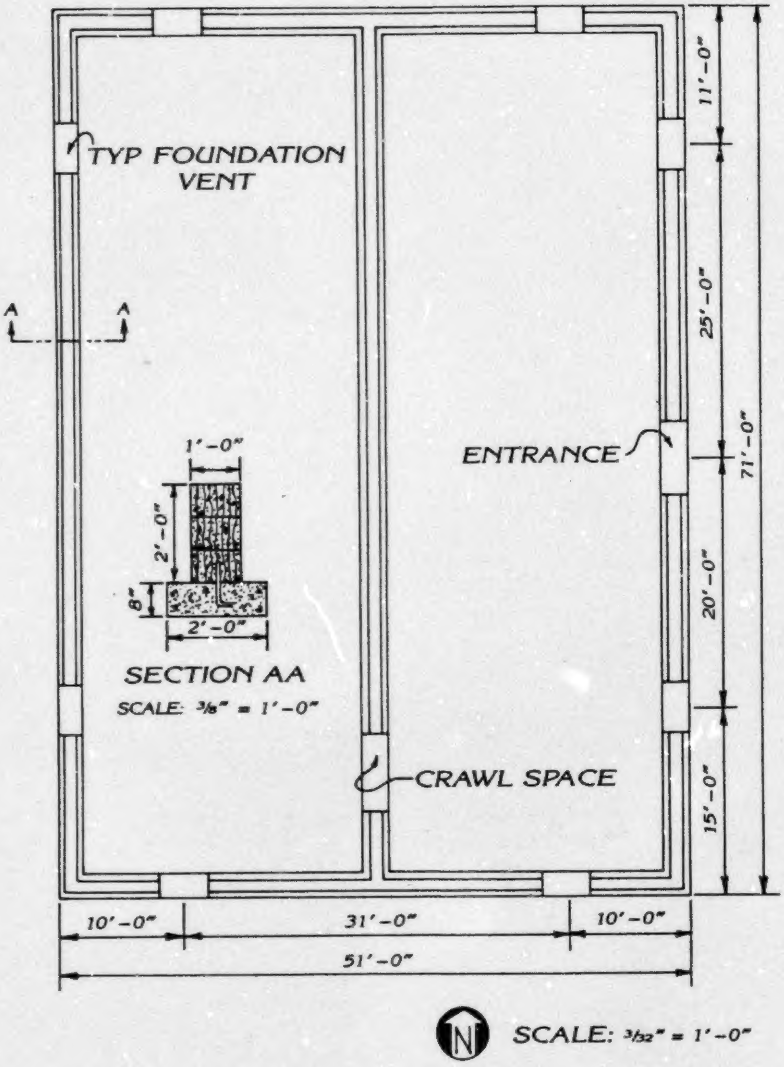

75' - 0"
UTILITY POLE
EASEMENT
5' - 11"
19' - 6"
PLOT PLAN
PROPERTY LINE
PROPERTY LINE
N
CHURCH
99' - 6"
65' - 0"
99' - 6"
10' - 2"
10' - 10"
6' - 10"
54' - 0"
4' - 0"
20' - 5"
SIDEWALK
15' - 0"
PROPERTY LINE
75' - 0"
6" CURB
CHEROKEE DRIVE
100' - 0"


PLOT PLAN
UTILITY POLE
EASEMENT
PROPERTY LINE
PROPERTY LINE
PROPERTY LINE
CHURCH
N
SCALE: 3/32" = 1'-0"
6'-0"
11'-6"
70'-0"
99'-6"
12'-0"
5'-0"
14'-6"
50'-0"
10'-6"
75'-0"
SIDEWALK
6" CURB
BENCH MARK
100'-0"
CHEROKEE DRIVE

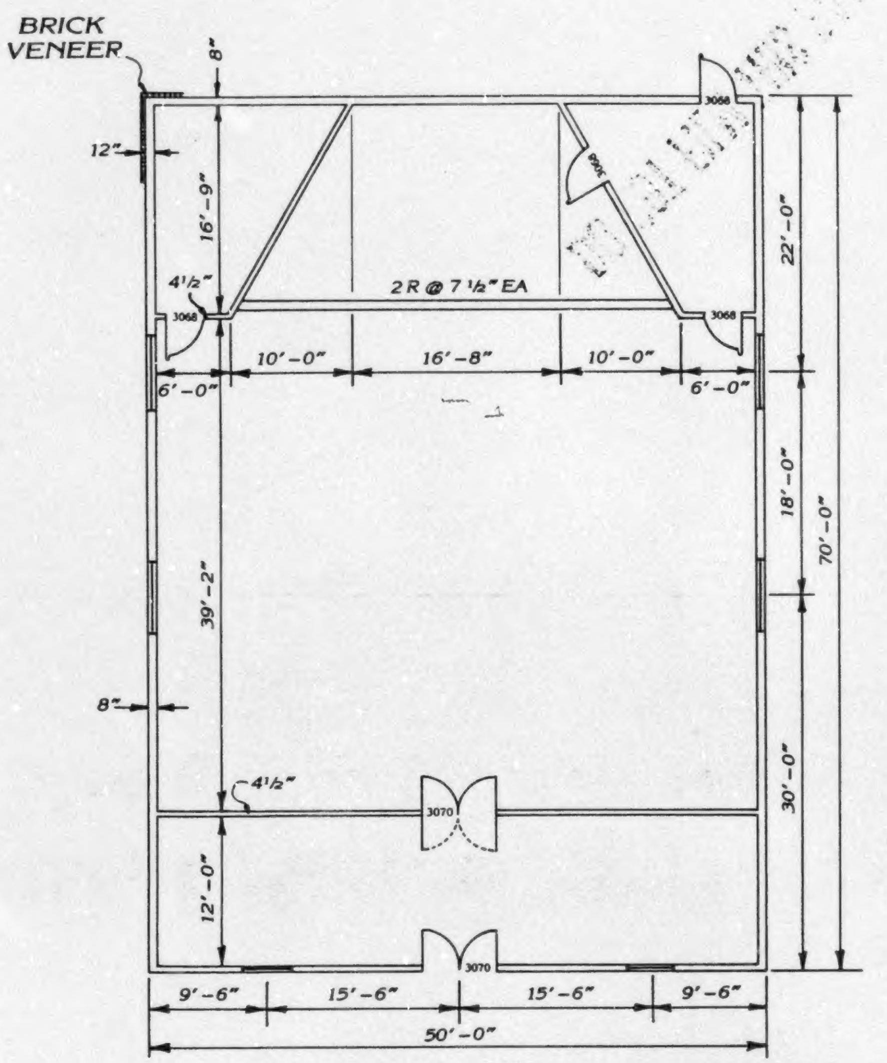
JOB SHEET SUPPLEMENT #1

FC-106-D

FOUNDATION PLAN


TYP FOUNDATION VENT
A
A
1'-0"
2'-0"
8"
2'-0"
SECTION AA
SCALE: 3/8" = 1'-0"
ENTRANCE
CRAWL SPACE
11'-0"
25'-0"
20'-0"
15'-0"
71'-0"
10'-0"
31'-0"
10'-0"
51'-0"
N
SCALE: 3/32" = 1'-0"

FLOOR PLAN


BRICK VENEER
8"
12"
16'-9"
4½"
3068
2 R @ 7½" EA
3068
3068
3068
10'-0"
16'-8"
10'-0"
6'-0"
6'-0"
22'-0"
18'-0"
70'-0"
39'-2"
8"
4½"
3070
30'-0"
12'-0"
3070
9'-6"
15'-6"
15'-6"
9'-6"
50'-0"

N SCALE: 3/32" = 1'-0"

SITE LAYOUT
UNIT II

JOB SHEET #1 — ERECT BATTER BOARDS AND LOCATE BUILDING LINES FOR A STRUCTURE

I. Tools and materials

   A. Tools

      1. Sledgehammer
      2. Claw hammer
      3. Crosscut handsaw
      4. Power handsaw (if electricity is available on site)
      5. Builder's level and transit
      6. String line
      7. Tapes
      8. Plot plan (Job Sheet Supplement #1)
      9. Pencil

   B. Materials

      1. Batter-board stakes, 2×4s
      2. Ledger boards, 1×6s
      3. Braces (if necessary), 1×4s
      4. Corner stakes, 2×2s
      5. 8d box nails

II. Procedure

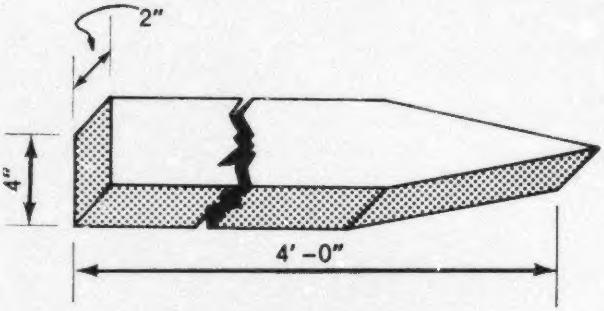
(NOTE: The procedure given in this job sheet is just one of several acceptable methods.)

   A. Cut material to size

JOB SHEET #1

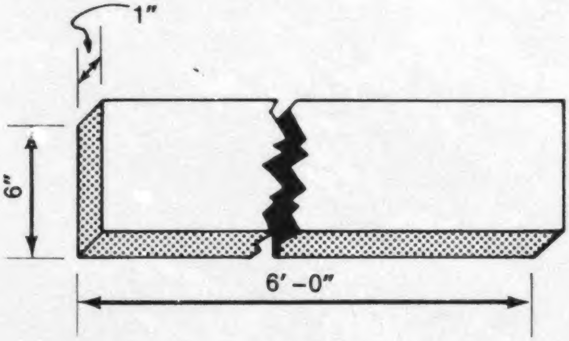
1. Cut batter-board stakes to dimensions and configurations shown in Figure 7

FIGURE 7



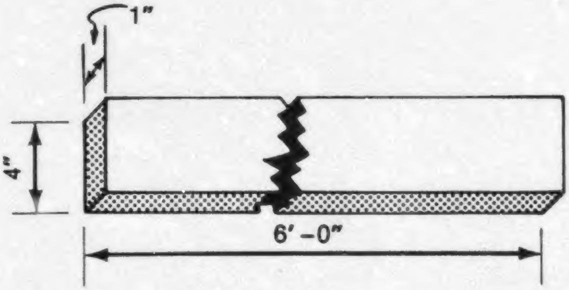
2. Cut ledger boards (Figure 8)

FIGURE 8



3. Cut braces (Figure 9)

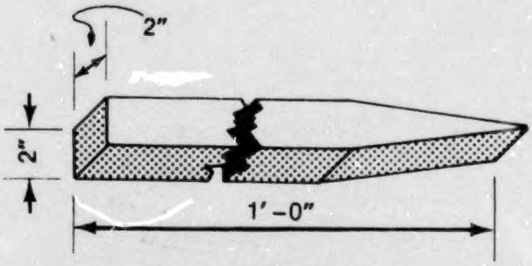
FIGURE 9



JOB SHEET #1

4. Cut corner stakes to dimensions and configurations shown in Figure 10

FIGURE 10

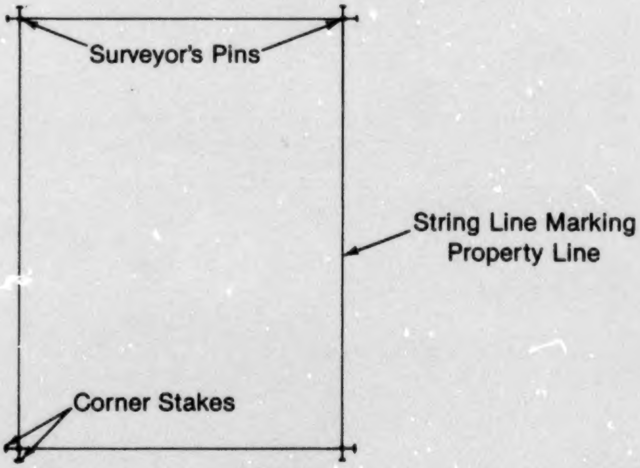


B. Mark property lines with string line

1. Locate surveyor's pins marking four corners of property
2. Set corner stakes beside surveyor's pins (See Figure 11)
3. Attach string line to corner stakes (Figure 11)

   (NOTE: Leave property string line in place until exact building lines have been established.)

FIGURE 11



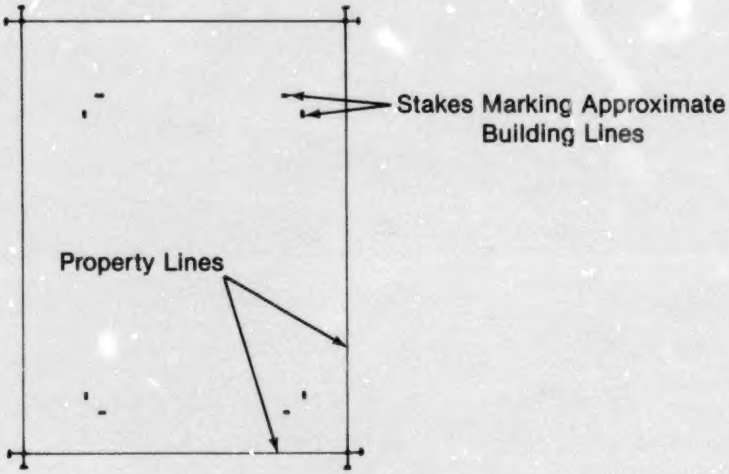
C. Mark approximate location of building lines with string line

1. Using property lines and plot plan as reference, measure to determine approximate location of building lines; mark approximate building lines by driving at least two stakes along each line (See Figure 12)

   (NOTE: Nails or other temporary markers may be used to mark these lines.)

JOB SHEET #1

FIGURE 12

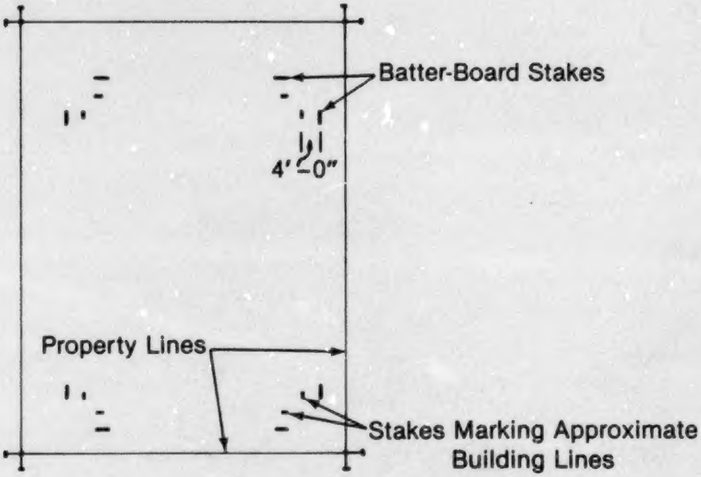

Stakes Marking Approximate Building Lines
Property Lines

2. Erect batter boards

   a. Measure a point at least 4 feet behind each stake marking approximate building lines; drive a batter-board stake at each point (Figure 13)

   (NOTE: When setting batter-board stakes for large structures, set stakes at least 20 feet outside approximate building lines to leave work room for heavy equipment.)

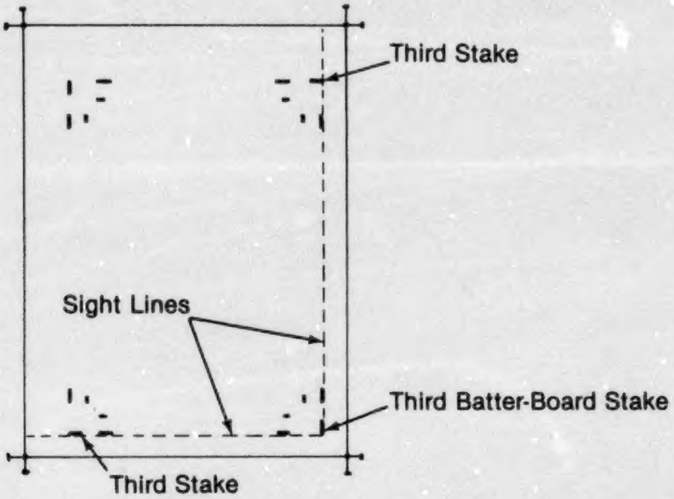
FIGURE 13


Batter-Board Stakes
4'-0"
Property Lines
Stakes Marking Approximate Building Lines

JOB SHEET #1

b. To determine location of corner stake for each batter board, sight a line parallel to two batter board stakes on each line of angle; drive third batter board stake where two lines intersect (Figure 14)

FIGURE 14


Third Stake
Sight Lines
Third Batter-Board Stake
Third Stake

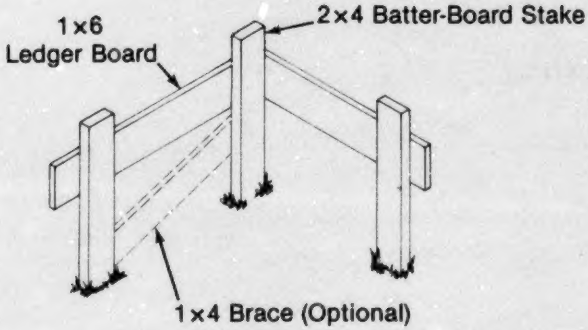
c. Use builder's level to locate elevation on each batter-board stake

d. Nail ledger boards at correct elevation on batter-board stakes (See Figure 15)

e. Nail braces to batter board stakes if necessary (Figure 15)

(NOTE: Braces are used when the soil is loose or when the batter-board stakes must be taller than 3 feet.)

FIGURE 15

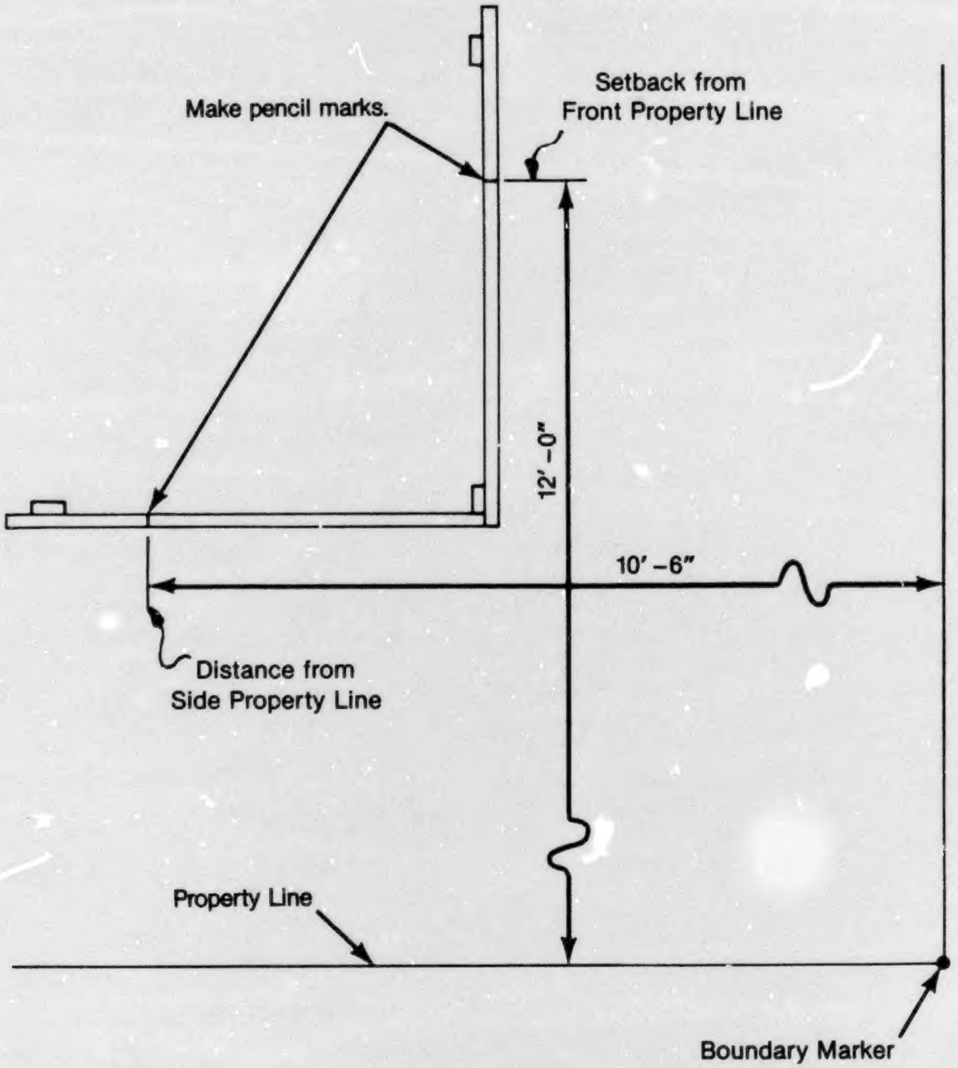

1×6
Ledger Board
2×4 Batter-Board Stake
1×4 Brace (Optional)

JOB SHEET #1

D. Mark permanent building lines with string line

1. Measure from property lines to ledger boards; make pencil mark on top of ledger boards (Figure 16)

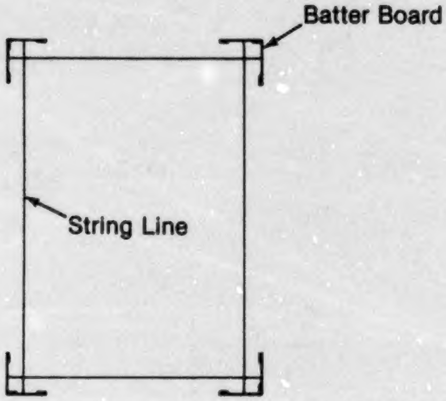
FIGURE 16


Make pencil marks.
Setback from Front Property Line
12′ –0″
10′ –6″
Distance from Side Property Line
Property Line
Boundary Marker

JOB SHEET #1

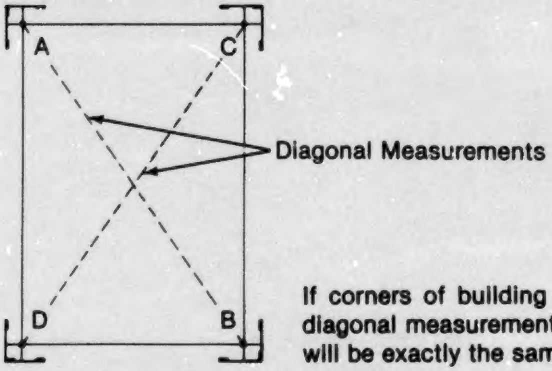
2. Drive nails at pencil marks on ledger boards; attach string lines to nails and stretch as shown in Figure 17

FIGURE 17


Batter Board
String Line

3. Check squareness of corners by using diagonal method (Figure 18), 3-4-5 rule (Figure 19), or transit method (Figure 20), and adjust string lines as necessary

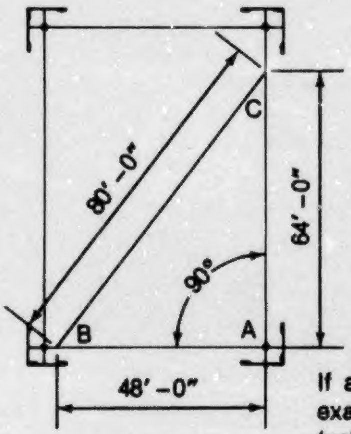
FIGURE 18: Diagonal method


A
C
Diagonal Measurements
D
B

If corners of building lines are square, both diagonal measurements (line AB and line CD) will be exactly the same.

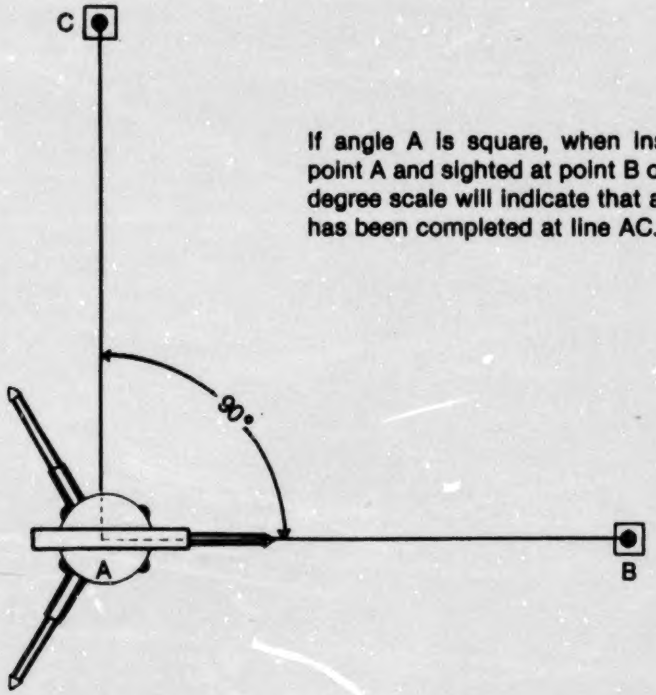
JOB SHEET #1

FIGURE 19: 3-4-5 rule



If angle A is square and measurements are exact, line BC will measure exactly 80 feet (using the 48-64-80 multiple of 3-4-5).

FIGURE 20: Transit method

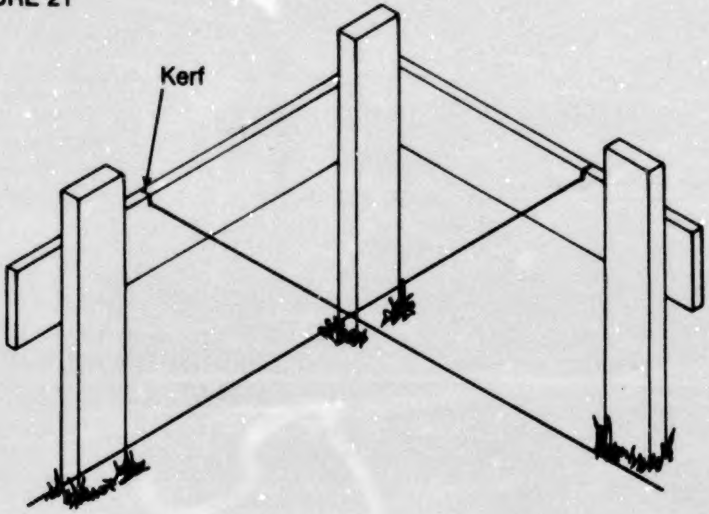


If angle A is square, when instrument is at point A and sighted at point B on line AB, 360-degree scale will indicate that a 90-degree arc has been completed at line AC.

JOB SHEET #1

4. After corners have been squared, saw kerf in ledger boards at exact squared location; attach string to kerf to keep string from shifting (Figure 21)

FIGURE 21



E. Clean work area; store tools and materials properly

SITE LAYOUT
UNIT II

JOB SHEET #2 — LAY OUT FOOTINGS FOR A STRUCTURE

I. Tools and materials

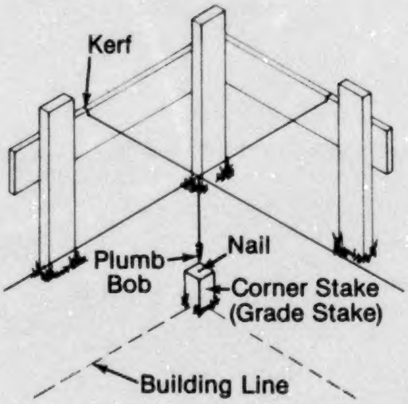
- A. Foundation plan (Job Sheet Supplement #2) and floor plan (Job Sheet Supplement #3)
- B. Plumb bob
- C. Pencil
- D. String line
- E. Tape
- F. Sledgehammer
- G. Claw hammer
- H. Crosscut handsaw
- I. Power handsaw (if electricity is available on site)
- J. Builder's level
- K. 8d box nails
- L. Corner stakes, 2" x 2" x 1'
- M. Footing-line stakes, 2" x 4" x 18"

II. Procedure

- A. Locate building lines (See Job Sheet #1)
- B. Locate and drive grade stakes
    - 1. Plumb down from intersection of string lines marking each corner of building lines; drive corner stakes (grade stakes) at these points (See Figure 22)
    - 2. Use builder's level to establish grade
    - 3. Drive nail in top of each grade stake to locate exact point of intersection (See Figure 22)

JOB SHEET #2

FIGURE 22


Kerf
Plumb Bob
Nail
Corner Stake (Grade Stake)
Building Line

4. Remove plumb bob

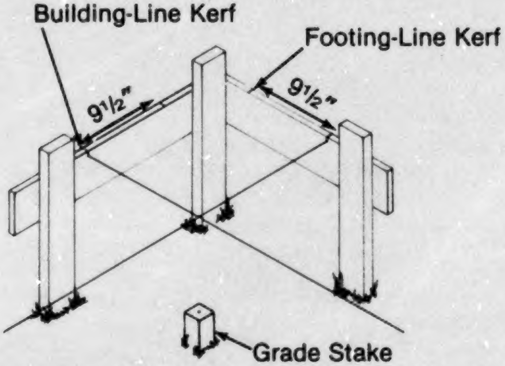
C. Establish footing lines on batter boards

1. Determine from foundation plan and floor plan how far outside of building lines the footing forms will extend

   (NOTE: Since footings are 2 feet wide and the finished walls are 8 inches thick, the footing lines will have to be set 8 inches both ways from the building lines, and another 1½ inches will have to be added to allow for the thickness of the forms on each side.)

2. Measure over 9½ inches from building-line kerf; mark this measurement on top of batter boards, and saw kerf on this mark (Figure 23)

FIGURE 23


Building-Line Kerf
Footing-Line Kerf
9½"
9½"
Grade Stake

3. Drive a nail into ledger board at kerf

   (NOTE: The nail at this point will help distinguish footing line from building line.)

JOB SHEET #2

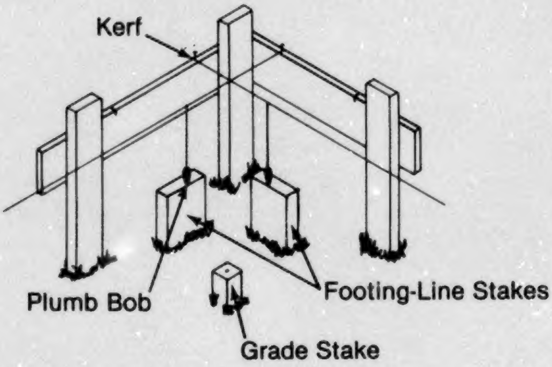
4. Perform this procedure on all batter boards

5. Move string line from building-line kerfs to footing-line nails and stretch from one footing-line nail to the next, continuing around proposed structure

D. Set form stakes

1. Use plumb bob to locate position of footing-line stakes at each corner of proposed structure (Figure 24)

FIGURE 24



2. Transfer grade from grade stakes to footing-line stakes

3. Remove grade stakes

4. Attach string line to stakes; stretch the line tightly from one footing-line stake to the one on opposite end of footing; center the line on the grade that was transferred to those stakes

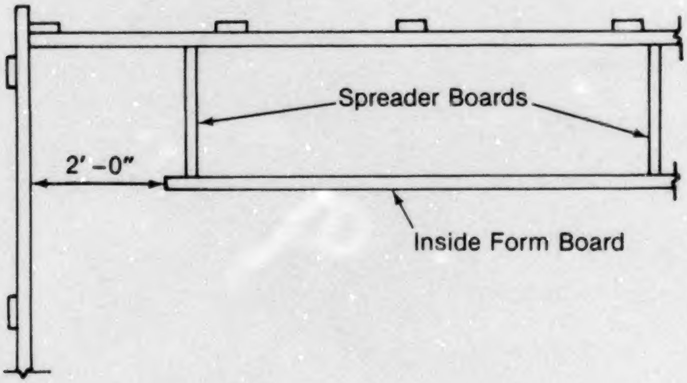
5. Lay out form boards along the footing line

6. Set stakes approximately every 4 feet, and nail form boards on grade to these stakes to establish the outside forms

7. Cut two spreader boards 2 feet long and place against outside forms; set inside form board against these spreaders (See Figure 25)

JOB SHEET #2

FIGURE 25



8. Set stakes for inside form

   (NOTE: When driving stakes against inside form, drive stakes straight down so that there is no force against the form, which would tend to move the outside form out of line.)

9. Continue setting stakes and nailing forms to grade until all forms are set

   (NOTE: Alignment of forms can be checked by using the plumb bob attached to the string line.)

E. Clean work area; store all tools properly

SITE LAYOUT
UNIT II

JOB SHEET #3 — SET GRADE STAKES FOR FOOTINGS WITHOUT FORMS

I. Tools and materials

  A. Foundation plan provided by instructor

  B. Builder's level and rod

  C. Sledgehammer

  D. 18-inch-long reinforcement bars to use as grade stakes

  (NOTE: 2×4 or 1×4 stakes could also be used as grade stakes.)

II. Procedure

  (NOTE: After footings have been excavated, it is necessary to set grade stakes for concrete.)

  A. In the center of the footing excavation, drive stakes every 8 feet to 10 feet

  B. Set each stake at grade

    1. While an assistant shoots grade with builder's level, hold rod on top of stake

    2. Remove rod and drive stake with sledgehammer until top of stake is approximately on grade

    3. Hold rod on top of stake and check grade

    4. Continue driving stake and rechecking grade until stake is on grade

SITE LAYOUT
UNIT II

TEST

NAME ____ SCORE ________________

1. Match to their correct definitions terms associated with site layout. Write the correct numbers in the blanks.

______a. Temporary framework on which to stretch a line to assist in locating corners and building lines when laying out a building

______b. Agreement between builder and city that specifies the type, quality, and extent of construction on structure to be erected

______c. A vested or acquired right to use land, other than as a tenant, for a specific purpose; such right being held by someone other than the owner who holds the title to the land

______d. Removing soil for footing or for establishing a uniform grade

______e. Top horizontal board on batter-board framework

______f. Drawing used to show location and size of structure(s), driveways, sidewalks, patios, property lines, utilities, and existing conditions

______g. Tool or device attached to a string; used to set or check plumb or perpendicular of a surface

______h. To plumb from a given point down to a point below

______i. Boundaries of a lot or plot of ground

______j. Slight indentation made with a saw; used to hold line in place

______k. Line established by law, fixing exterior face of structure a minimum distance from right-of-way or property line

______l. Art or science of determining the area and configuration of portions of the earth's surface

1. Excavating
2. Property lines
3. Plumb bob
4. Surveying
5. Kerf
6. Batter board
7. Setback line
8. Ledger board
9. Plumb down
10. Building permit
11. Plot plan
12. Easement

TEST

2. Match to their correct definitions terms pertaining to grades and leveling instruments. Write the correct numbers in the blanks.

______a. Given grade

______b. Soil or other substance used to raise grade level

______c. Proposed or future level of ground around structure

______d. Permanent point of known or assumed elevation

______e. Rod used with builder's level; graduated in tenths and hundredths of a foot or in inches and feet

______f. Elevation of finished floor in relation to bench mark

______g. The slope of a line, such as inches of fall per foot of run

______h. Instrument consisting of a telescope, leveling bubble, and tripod; used primarily for establishing grade levels

______i. Stake driven into ground, usually with top establishing finished level of ground or concrete at that point

______j. Vertical distance from bench mark to line of sight of instrument

______k. Instrument consisting of a telescope, leveling bubble, leveling head, and tripod; used primarily to establish angles and straight lines

1. Grade line
2. Fall
3. Leveling rod
4. Transit
5. Grade stake
6. Bench mark (BM)
7. Height of instrument (HI)
8. Fill
9. Builder's level
10. Finish-floor grade
11. Elevation

3. Name factors pertinent to site layout.

a.____

b.____

c.____

d.____

e.____

f.____

TEST

4. Select from the following list information used to lay out building lines. Write an "X" in the blank before each correct answer.

______a. Dimensions (length and width) of building

______b. Setback from property lines

______c. Direction building faces

______d. Location of all utilities on plot

______e. Location of bench mark and grade

______f. Location and dimensions of easement(s)

______g. Distance from utility pole to building

______h. Setback from curb

______i. Orientation of building on lot (square or diagonal)

______j. Location of water supply

______k. Dimensions of property

______l. Setback from sidewalk

5. State the purpose of batter boards.

____

____

6. Describe common methods used to square building lines.

a. 3-4-5 rule—____

____

____

b. Diagonal method—____

____

____

____

TEST

c. Transit method—____

____

____

____

(NOTE: Test question 7 lists the job sheets. They are an important part of this test. If they have not been completed, check with your instructor.)

7. Demonstrate the ability to

   a. Erect batter boards and locate building lines for a structure.

   b. Lay out footings for a structure.

   c. Set grade stakes for footings without forms.

SITE LAYOUT
UNIT II

ANSWERS TO TEST

1.
   - a. 6
   - b. 10
   - c. 12
   - d. 1
   - e. 8
   - f. 11
   - g. 3
   - h. 9
   - i. 2
   - j. 5
   - k. 7
   - l. 4

2.
   - a. 11
   - b. 8
   - c. 1
   - d. 6
   - e. 3
   - f. 10
   - g. 2
   - h. 9
   - i. 5
   - j. 7
   - k. 4

3.
   - a. Local regulations and covenants (zoning and restrictions)
   - b. Location of utilities
   - c. Presence of existing trees and shrubs
   - d. Contour or shape of site
   - e. Characteristics of soil
   - f. Orientation of site

4. a, b, e, f, h, i, k, l

5. To provide a place for stretching a line used to establish building lines for excavation and construction

6. Description should include the following

   a. 3-4-5 rule—Forming a right triangle using largest multiple of 3-4-5 possible for length of lines being squared, and ensuring that longest side of triangle is exact appropriate multiple of 5

   b. Diagonal method—Measuring diagonally from inside corners of layout and ensuring that diagonal lines are equal in length

   c. Transit method—Setting instrument exactly at point where right angle is to be, sighting a reference point on one line of angle, setting 360-degree scale at zero, and establishing second line of angle where scale indicates a 90-degree arc has been completed

7. Performance skills evaluated to the satisfaction of the instructor